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Consumer Demand for Dairy Products

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ABSTRACT

Rising consumer incomes and declining prices for dairy products relative to other foods caused most of the 2-percent average annual increase in per capita consumption posted from 1983 through 1986. Advertising, concern about health and nutrition, changes in demographics, and Government donations also affected consumption. But these influences were small for most dairy products, compared with the effects of changes in relative prices and consumer incomes. With the exception of cheese and lowfat milk, per capita consumption of dairy products in the United States either trended downward or stagnated for the two decades prior to the early 1980's. Per capita consumption turned up, however, in the early 1980's. Consumption of items such as lowfat milk and cheese showed further gains, and consumption of most other dairy products bottomed out or increased modestly.

This report examines dairy market characteristics, the product composition of 1983-86 consumption increases, price and income effects on demand, and other factors affecting demand.

PREFACE

The upturn in consumption coincides with changes in dairy programs which: reduced support prices, increased donation levels, and expanded advertising and promotion efforts. In addition, per capita real income growth rates exceeded historical levels while relative dairy product prices fell during 1983-86. The National Commission on Dairy Policy asked the U.S. Department of Agriculture (USDA) to study the factors affecting the consumer demand for dairy products and, when possible, to evaluate the roles played by the various factors in the recent upturn in consumption. This study is one of several the Commission will use in developing their final report to Congress on recommendations on dairy policy.

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CHAPTER 1: SUMMARY

This study analyzes the 1980's upturn in per capita consumption of dairy products in the United States. It was requested by the National Commission on Dairy Policy for use in preparing its March 1, 1988, report to Congress. This study focuses on identifying and, when possible, quantifying the major determinants of demand for dairy products.^{1/}

Per capita consumption of total dairy products in the United States first trended downward then stagnated for the two decades prior to the early 1980's.^{2/} Per capita consumption of items such as whole milk declined while items such as lowfat milk and cheese trended upward. In the 1980's, per capita consumption of items such as lowfat milk and cheese increased at rates that more than offset decreases in other products, leading to an increase in the overall average consumption of dairy products.

Despite a slowdown in the U.S. population growth rate, per capita consumption increased enough during the 1980's to generate the sharpest prolonged increase in total consumption of all dairy products at the national level in decades.

Rising consumer incomes and declining prices for dairy products relative to other foods caused most of the 2-percent average annual increase in per capita consumption and the 3-percent increase in total consumption posted from 1983 through 1986. Advertising, concern about health and nutrition, changes in demographics, and Government donations also affected consumption. But these influences were small for most dairy products, compared with the effects of changes in relative prices and consumer incomes.

DAIRY MARKET CHARACTERISTICS

Several characteristics of the dairy market contribute, either directly or indirectly, to shaping consumption of dairy products.

From a supply perspective, the dairy sector is more heavily regulated than most other domestic agricultural industries. The Commodity Credit Corporation program authorized by the Agricultural Act of 1949 and the milk marketing orders authorized by the Agricultural Marketing Agreement Act of 1937 provide both price and income support to milk producers. Supports are implemented through direct Government purchases of manufactured dairy products to maintain minimum prices consistent with program targets. Imports are also restricted because foreign dairy products are generally available at lower--often subsidized--prices. Less than 4 percent of U.S. dairy products move abroad, mostly through assistance programs, and imports are limited to a roughly comparable share of the market. Hence, producers depend heavily on the domestic market and program decisions about support pricing.

^{1/} As requested by the Commission, this study is limited to analyzing demand relationships at the consumer level. Hence, specific linkages between farm and retail level price movements are not examined.

^{2/} Total dairy products on a milk-equivalent, milkfat basis.

From a consumption perspective, per capita use of dairy products has tended to decline over the long run. For example, while consumption in several individual product categories such as cheese and lowfat milk rose, overall consumption including donations of dairy products declined from a 1939 peak of 824 pounds per capita to a low of 542 pounds in 1981. Population over the period grew fast enough to keep total consumption rising slowly from 108 billion pounds to 123 billion pounds over the same period.

These supply and use characteristics combined in the late 1970's and early 1980's to generate large surpluses. Milk support prices were raised from \$3.71 per hundredweight (cwt) in 1965 to a high of \$13.49 for a short period in 1981. This rise stimulated production through its effects on cow numbers and milk yields per cow. While many factors including processing and marketing costs affect retail prices, milk support prices also influenced retail prices for dairy products. While retail dairy product prices declined relative to other food prices during at least part of this period, they were still likely higher than they would have been without milk price supports. High support prices also encourage the production and use of dairy substitutes.

With these forces at work, Government purchases on a milk-equivalent basis increased from 1 to 6 percent annually in the 1970's to a peak of 12 percent of farm marketings in 1983 when rising budget outlays stimulated program changes. Under resulting 1983 and 1985 changes in dairy legislation:

- o Support prices were linked directly to the amount of Government purchases beginning on April 1, 1985. From April 1 on, milk support prices fall when Government purchases exceed specified levels. Support prices have fallen six times in the intervening 35 months from \$13.10 in November 1983 to \$10.60 per cwt in January 1988.
- o The Temporary Emergency Food Assistance Program (TEFAP) sharply expanded cheese and butter donations to low-income consumers during 1983-85. TEFAP reduced donations slightly in 1986. Donations allowed some groups to consume more dairy products (or to substitute products such as butter for margarine) without purchasing the products in commercial outlets.
- o Dairy producers began paying assessments in 1984 to support research and promotion activities. The assessment of 15 cents per cwt on all milk marketed generates about \$200 million annually, most of which is spent on advertising and promotion. Expenditures for advertising dairy products have more than doubled over pre-1984 levels.

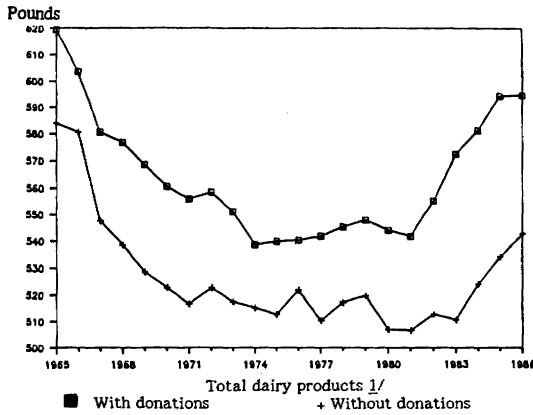
COMPOSITION OF THE 1983-86 INCREASES IN DAIRY CONSUMPTION

Per capita consumption of dairy products, excluding donations, increased an average of 2 percent per year in 1983-86, after declining an average of 1.5 percent per year from the mid-1960's to the mid-1970's and then leveling off until the early 1980's (fig. 1).

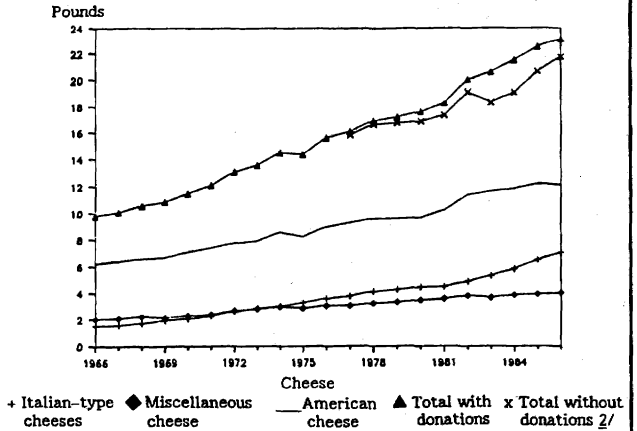
Most of this increase came from greater consumption of cheese. Per capita consumption of most other dairy products showed modest gains or stabilized. Per capita consumption of fluid milk rose modestly after long declines. Butter consumption per capita increased, but most of this increase was due

Figure 1—After historical declines, per capita consumption of total dairy products increased in the 1980's*

Excluding Government donations gives a clearer picture of consumption: per capita consumption rose in 1983 and has continued to rise through 1986.

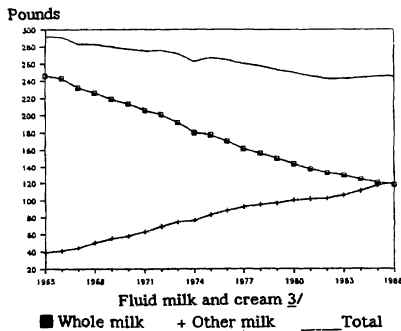


Almost all the increase in dairy products is attributable to the continued rise in per capita cheese consumption.

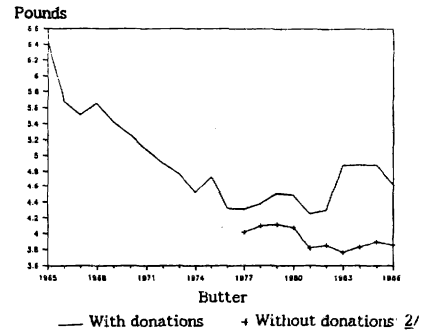


Per capita consumption of most other dairy products increased slightly.

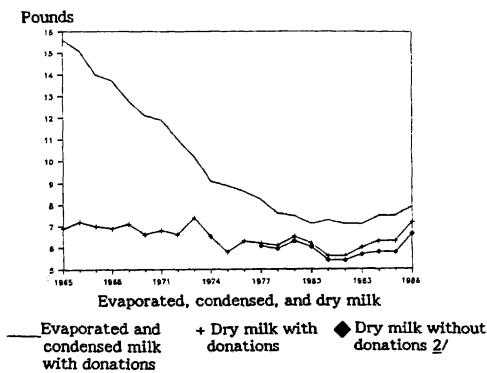
Fluid milk and cream increased slightly, after long declines. Consumption of lowfat milk is steadily replacing whole milk.



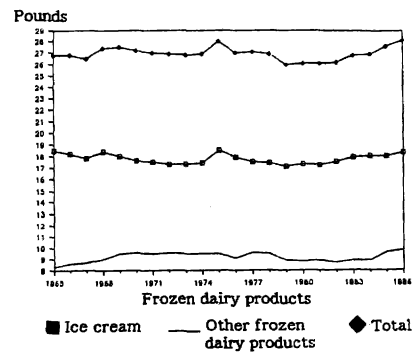
Recent increased donations raised butter consumption. Without donations, consumption levels out.



Consumption of evaporated, condensed, and dry milk rose.



Consumption of frozen dairy products shows little variation.



*Charts not drawn on proportional scales.

1/ Total dairy products on a milk-equivalent, milkfat basis.

2/ Data on donations of individual dairy products were not available prior to 1977.

3/ Including donations.

to greater donations. Evaporated, condensed, and dry milk consumption per capita increased after long declines. Frozen dairy products posted minor increases. However, gains in these categories contributed little to expanding total per capita consumption because of their relatively small volumes.

Per capita cheese consumption, including donations, has grown over 4 percent per year and has more than doubled since 1966. It is one of the few dairy products with steadily rising per capita consumption. This growth has been mainly in the away-from-home market and as ingredients in the processed-foods market. Strong growth in the pizza market has been particularly important. Home consumption of cheese per person declined from 1980 to 1984 and increased slightly from 1985 to 1986 due primarily to growth in processed cheeses (such as packaged, sliced American cheese). About 38 percent of cheese is consumed at home, about 39 percent away from home, and about 23 percent as ingredients.

Although per capita fluid milk consumption increased in 1982-86, the total increase (3.5 pounds) was not large enough to push consumption above the 1981 level of 245 pounds. Per capita consumption of fluid milk and cream has declined an average of 1 percent per year from 292 pounds in 1965 to 242 pounds in 1982. But this decline in fluid milk and cream products masks a rather significant change in its components: lowfat milk has steadily replaced whole milk. Per capita consumption of whole milk declined about 3 percent per year from 246 pounds in 1965 to 118 pounds in 1986. Other milk, mostly lowfat milk, increased at an average annual rate of 5 percent from 39 pounds per capita in 1965 to over 119 pounds in 1986.

Since 1976, per capita butter consumption excluding donations has stabilized at about 4.0 pounds, after declining 3.5 percent per year from 6.4 pounds in 1965. About 30 percent of butter is consumed at home, with 70 percent consumed in the ingredient and away-from-home markets. Butter consumed at home declined; the share consumed away from home and as ingredients increased.

Per capita consumption of frozen dairy products was relatively stable during 1965-86, rising from 26.8 pounds in 1965 to 28.1 pounds in 1986. Per capita consumption of ice cream, the largest component, was 18.5 pounds in 1965 and 18.3 pounds in 1986. Ice cream and related products consumed at home has increased since 1980.

Per capita consumption of evaporated and condensed milk products declined about 3 percent per year from about 16 pounds in 1965 to a low of 7 pounds in 1980, where it remained until 1984 before increasing to 7.9 pounds in 1986. Consumption of dry milk products fluctuated between a high of 7.4 pounds (1973) and a low of 5.6 pounds (1981). Since 1981, consumption increased to 7.2 pounds per capita by 1986. But without donations, consumption would have increased from 5.4 to 6.6 pounds.

PRICE AND INCOME EFFECTS ON DEMAND

The effects of prices and income on per capita consumption were measured using a complete demand system based on time-series analysis. Statistical measures indicate that these two factors explain most of the movements in per capita levels. The difference between actual and simulated per capita levels was less than 5 percent for all dairy products. Analysis of income

effects from household survey data also pointed to the importance of changes in income in shaping per capita consumption.

Time-Series Analysis

The analysis summarized here suggests that demand for dairy products is sensitive to a number of factors but that sensitivity to changes in relative prices and income is the most pronounced. This sensitivity combined with sharply rising consumer incomes and falling dairy prices relative to other foods generated most of the 1983-86 increase in consumption.

Retail prices for dairy products have risen less than most other foods for most of the 1980's. Dairy product prices rose an average of 1.2 percent annually since 1981, while prices for all other foods rose more than 3 percent (measured using the Consumer Price Index). This effectively lowered relative dairy product prices. Consumers' purchasing power (real disposable per capita income) also increased over 3 percent per year during 1983-86, an increase over the 2-percent pace of the 1965-83 period.

The sensitivity of dairy demand to changes in prices and incomes was gauged using econometric models of demand relating per capita consumption of broad food aggregates to prices and incomes. The models were also used to determine the effects of prices and income on per capita consumption of specific dairy products. The models are described briefly in the box and in greater detail later in the report.

This sensitivity analysis suggests that:

Decreasing prices increases consumption. A 10-percent decrease (increase) in price increases (decreases) per capita consumption of total dairy products by about 3 percent, all other factors remaining constant (fig. 2 and table 1). Table 1 also shows the estimated relationships between price changes and consumption changes for the major individual dairy products. Decreasing prices by 10 percent:

- o Raises per capita consumption of cheese 3.3 percent;
- o Raises per capita consumption of fluid milk 2.6 percent;
- o Raises per capita consumption of butter 1.7 percent;
- o Raises per capita consumption of evaporated, condensed, and dry milk products by 8.3 percent; and
- o Raises per capita consumption of frozen dairy products 1.2 percent (fig. 2, table 1).

Increased income does not always raise consumption. A 10-percent increase (decrease) in income increases (decreases) per capita consumption of total dairy products 1.8 percent (table 1). But this same 10-percent increase in income affects individual dairy products differently. It:

- o Lowers per capita consumption of fluid milk about 2.2 percent;
- o Lowers per capita consumption of evaporated, condensed, and dry milk products 2.7 percent;

Prices and Income Affect Demand for Dairy Products

We examined what happens to the quantities of dairy products consumed when prices and incomes change. Elasticity estimates were obtained from time series econometric models that incorporated prices of all foods, an index of nonfood prices, and income.* These elasticities measure the percentage change in the quantity consumed for a given percentage change in price or income (see table 1). We assumed that changes in price or income had a negligible effect on per capita consumption when the elasticities were smaller than their standard errors. For example, changes in income had little or no effect on consumption of butter and frozen and other dairy products because the elasticities were smaller than their standard errors.

We also used household survey data to estimate income elasticities for the at-home component of the market. The data are based on cross-sectional expenditure observations and can be used to develop measures of the effects of income when factors other than just prices and income are considered.

Estimated price elasticities show that a change in price affects consumption in the opposite direction; all price variables have negative coefficients. For example, a -0.31 elasticity indicates that a 10-percent decrease in price increases per capita dairy consumption about 3 percent (table 1). A change in income affects consumption in the same direction if measured in terms of a dairy product total. But the effect of a change in income on the consumption of individual products differs as reflected in both the sign and the magnitude of the elasticities (table 1).

We used econometric models, from which the time-series estimates in table 1 were obtained, to simulate annual per capita consumption levels for the dairy product categories shown in table 1. The simulated and actual per capita consumption levels for individual dairy product categories over 1954-86 correspond closely (fig.3). Statistical measures of the discrepancy between the actual and simulated levels show that, on average, the discrepancy relative to the mean of actual per capita consumption was less than 5 percent

* See Huang, K.S. U.S. Demand for Food: A Complete System of Price and Income Effects, TB-1714, U.S. Dept. Agr., Econ. Res. Serv., Dec. 1985; and Huang, K.S. and Haidacher, R.C. "Estimation of a Composite Food Demand System for the United States," Journal of Business and Economic Statistics, Vol. 1, No. 4 (Oct. 1983), pp. 285-91.

for all dairy product categories. Other studies using econometric models also show that prices and income significantly influence per capita consumption.

Table 1--Price and income elasticities for dairy products 1/

Products	: Price elasticity : : (time-series) :	: Income elasticity : : (time-series) :	: At-home income : elasticity : (household survey)
	<u>Coefficient</u>		
Total dairy products	: -0.31 : (.03)	: 0.18 : (.05)	: 0.14 : --
Fluid milk	: -.26 : (.12)	: -.22 : (.07)	: .02 : --
Cheese	: -.33 : (.12)	: .59 : (.12)	: .32 : --
Butter	: -.17 : (.17)	: .02 : (.19)	: .35 : --
Evaporated, condensed, and dry milk	: -.83 : (.26)	: -.27 : (.22)	: -.12 <u>2/</u> : --
Frozen and other dairy products	: -.12 : (.08)	: .01 : (.06)	: .21 : --

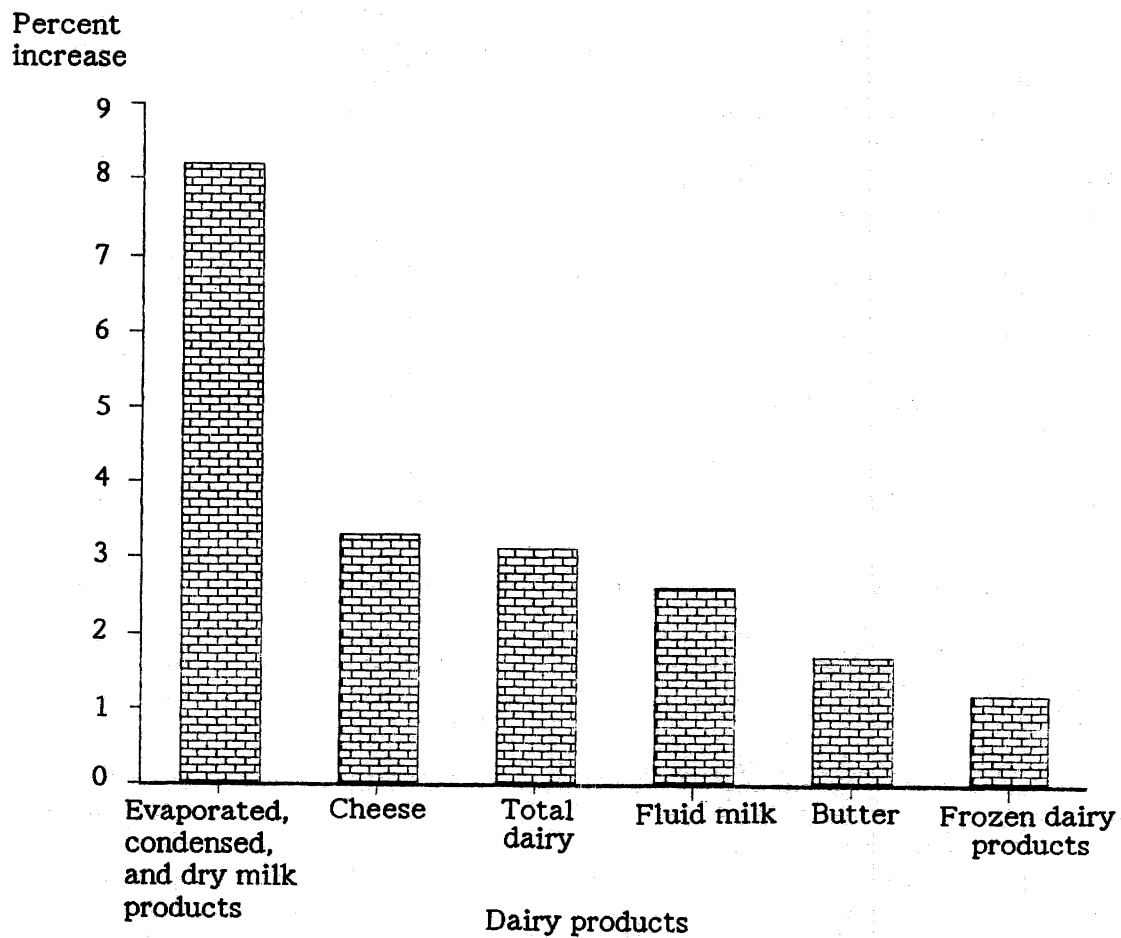
Note: The upper numbers are the elasticity estimates. The numbers in parentheses are the standard errors.

-- = Standard errors of elasticities were not calculated but elasticities are derived from statistically significant parameter estimates (except for fluid milk).

1/ Note that the elasticities in columns 1 and 2 relate product consumption to prices and income, while the elasticities in column 3 measure the responsiveness of product expenditures to income changes.

2/ Includes only canned milk.

Figure 2--Per capita consumption of all dairy products would rise if prices fell 10 percent



- o Hardly affects per capita consumption of butter and frozen dairy products; and
- o Raises per capita consumption of cheese about 6 percent.

These income elasticities are based on time-series demand models. Since it is difficult to isolate the effects of time trends and income on consumption in time-series analysis, it should be recognized that the income elasticities may embody trend effects.

Household Survey Analysis

Elasticities derived from household expenditure surveys provide an added measure of the sensitivity of demand to changes in income that are also free of trend effects. The time-series elasticities shown in columns 1 and 2 of table 1 are measured in quantity terms while the survey elasticities shown in column 3 are measured in terms of expenditures for at-home use only. A 10-percent increase in income increases per capita at-home expenditures on total dairy products 1.4 percent (table 1). As in the time-series analysis, a 10-percent increase in income affects per capita at-home expenditures on individual dairy products differently. Such an increase:

- o Has little or no effect on per capita fluid milk expenditures;
- o Lowers per capita expenditures on canned milk 1.2 percent;
- o Raises per capita expenditures on frozen and other dairy products 2.1 percent; and
- o Raises per capita expenditures on butter and cheese over 3 percent each.

OTHER FACTORS ALSO AFFECT DEMAND FOR DAIRY PRODUCTS

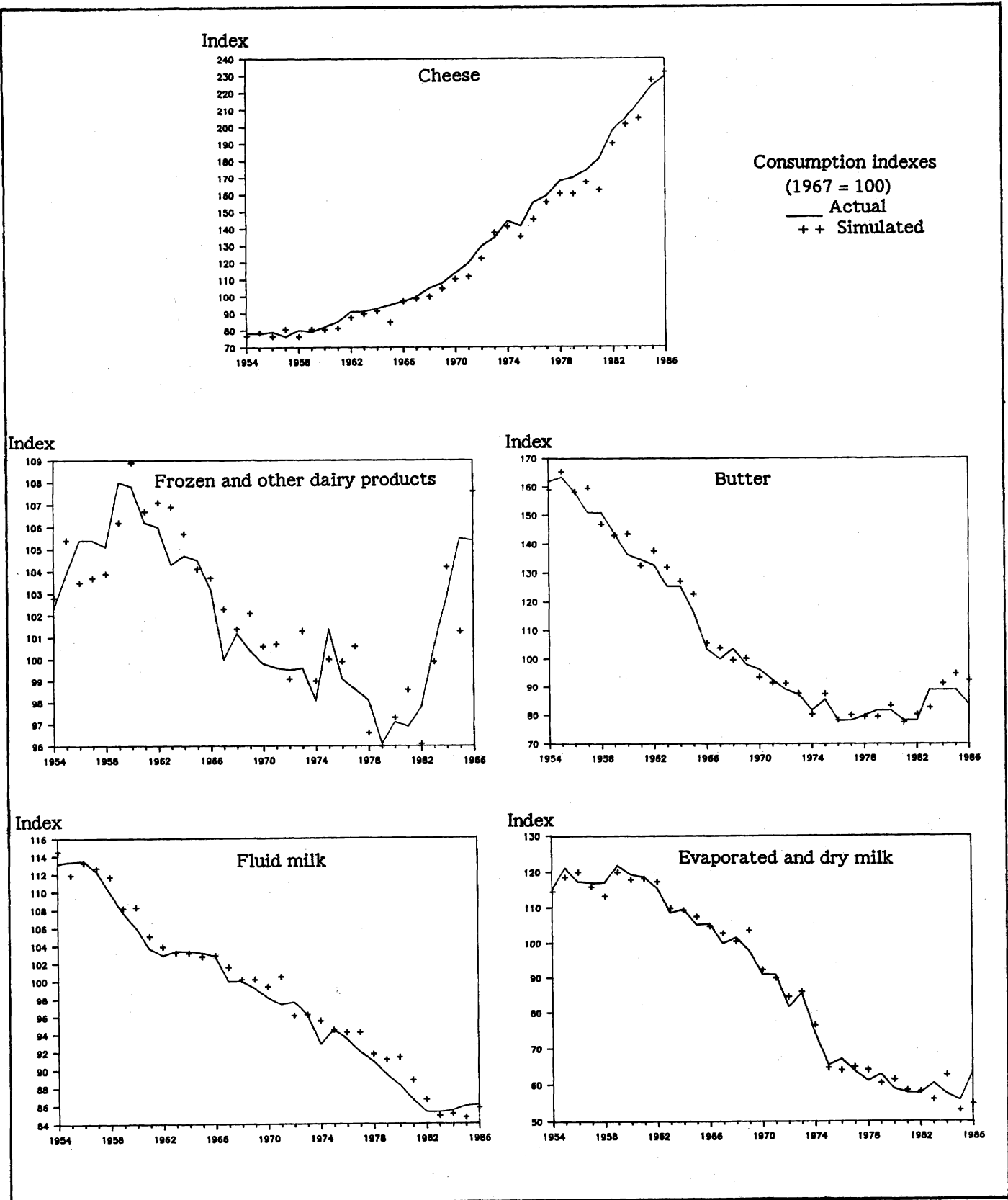
While changes in relative prices and consumer income explained much of 1983-86's consumption gains, other factors such as advertising, concern about health and nutrition, and Government donations also influenced consumption.

Demographic changes, except population growth, have little influence on year-to-year changes in consumption at the national level because factors such as regional, racial, and age distributions change slowly over time. Even in the long run, the combined effect of the changes in these factors projected to 2000 would increase per capita cheese consumption at home by less than 1.4 percent (table 2). Demographic factors are more important, however, in explaining variations in expenditures between households and between at-home and away-from-home consumption.

Advertising may also have bolstered per capita consumption of some dairy products, especially fluid milk and cheese. But the effect appears to have been small when compared with price and income effects.^{3/} After netting out

^{3/} This report makes no attempt to analyze whether advertising has increased sales enough to justify the advertising expenditures. The National Commission on Dairy Policy requested that a group of university researchers conduct a separate study to evaluate advertising effectiveness.

Figure 3—Simulated annual per capita consumption of dairy products



CHAPTER 2: THE DAIRY SECTOR

The U.S. dairy sector is more regulated than most domestic agricultural industries. The Agricultural Act of 1949 and the Agricultural Marketing Agreement Act of 1937 provide the basic legislative authorization for current price supports, government purchases of surplus production, and the Federal milk marketing order program. Because these programs affect prices and production, they indirectly impact consumption. To fully understand recent changes in observed consumption levels, it is necessary to review how the dairy industry programs have changed. This section summarizes changes in programs which affect support prices, Commodity Credit Corporation (CCC) purchases of surplus stocks, advertising expenditures, and cow numbers.

Many of the program changes were made in response to the rising cost of support programs. Government purchases increased from 2-5 percent of total milk marketed in the late 1970's to 12 percent in 1983. Program changes provide for reductions in support prices, product promotion, and surplus stock reduction.

POLICY CHANGES

Several recent changes in legislation and program management were enacted to curb high Government purchases. For example, two programs to reduce supply (the Dairy Diversion and Dairy Termination Programs) have been implemented since 1982; support prices have fallen and are now tied to projected Commodity Credit Corporation (CCC) purchases; foreign and domestic assistance programs are using more surplus stocks; and dairy farmers are funding a major dairy promotion program. These dairy programs as well as economic factors affect milk production.

Dairy price supports in the late 1970's and early 1980's stimulated milk production above commercial needs and usual Government uses. Also contributing to overproduction during this period were declining feed prices and increasing profitability as indicated by relatively high milk/feed price ratios.

Dairy Programs

Expanding surplus stocks and the associated budget outlays stimulated new dairy legislation in 1983 and 1985 that affect production, surplus stocks, donations, and consumption of dairy products. The Food Security Act of 1985 linked adjustments in support prices to the amount of Government purchases. Support prices, which reached a high of \$13.49 in October 1981, fell to \$11.10 per cwt in October 1987. Future adjustments will depend on projected Government dairy product purchases in each of the calendar years 1988 through 1990.

The Dairy Promotion and Research Order of March 23, 1984, implemented the national dairy product promotion, research, and nutrition education programs authorized under the Dairy and Tobacco Adjustment Act of 1983. Funded by a 15-cent per cwt assessment on all milk marketed by dairy farmers, the programs are administered by a board of 36 dairy farmers appointed by the Secretary of

Agriculture. Programs include an advertising program for major dairy products, nutrition education, nutrition research, and product research and development. Producers in any area containing qualified regional research and promotion boards can designate up to 10 cents per cwt of their 15-cent checkoff to be channeled to the qualified regional programs. The effectiveness of such programs are under the scrutiny of concerned producers; the legislation requires that USDA submit an annual evaluation report to Congress.

The Food Security Act of 1985 set a precedent of modifying Federal milk marketing orders (regulations specifying minimum prices and conditions under which milk can be bought and sold within a specified area) by legislation. Prior to this, changes in Federal order provisions were generally based on testimony of interested parties at Federal order hearings. Minimum Class I differentials (additional amounts per cwt that regulated handlers are required to pay farmers for milk used to produce fluid milk products) were increased in eastern, southern, and many midwestern Federal orders. These changes helped align prices of fluid, or Class I milk (aligning the upper Midwest pricing base with the cost of procuring milk from alternative sources). These differentials may be changed after 2 years.

PRICES, PRODUCTION, AND UTILIZATION

The current supply situation in the U.S. dairy industry is rooted in the price-support increases in the late 1970's and in special programs designed to curb excess milk supplies in the 1980's. Table 3 summarizes the production trends from 1965 through 1986. The effects of increasing milk prices and the increasing ratio of milk prices to feed prices on milk production may be inferred from the data in the table.

Prices

The entire milk-pricing structure is undergirded by the support price. Support prices indirectly affect retail milk and dairy product prices since manufacturing, Grade A, and average all-milk wholesale price changes generally move in the same direction as support prices (table 3). While many factors, including processing and marketing costs and supply/demand conditions, determine retail dairy product prices, the support price level is an important factor because of its relationship to wholesale prices and input costs for processors.^{4/} Support prices reached a high of \$13.49 per cwt in October 1981 and declined to \$11.10 in October 1987. High support prices increase the profitability of dairy production and encourage higher production levels, all else constant.

The profitability of milk production is also linked to feed prices. At a given milk price, profitability of producing milk increases as feed costs decrease. With all other factors equal, an increased milk/feed price ratio encourages higher rates of concentrate feeding and increased milk production per cow.

A sustained increase in the milk/feed price ratio, as well as high support prices, eventually encourage increased capital investment in dairy farming, all else held constant. From 1965-86, the milk/feed price ratio was lowest in

^{4/} See Kinnucan and Forker for empirical estimates of the relationship between retail milk product prices and the wholesale level all-milk price (15). Underscored numbers in parentheses refer to literature cited in the References section.

1965 at 1.18, peaked at 1.79 in 1986, and ranged between 1.31 and 1.53 in the remaining years (table 3). The ratio partially reflects the relative availability of grain. For example, 1975's low ratio of 1.31 reflects the relative grain shortage existing after the massive grain-exporting years in the early 1970's. The high 1986 ratio of 1.70 reflects the current world grain surpluses.

Table 3--Dairy production, consumption, factors, and prices, 1965-85

Items	1965	1970	1975	1980	1982	1983	1984	1985	1986
<u>Billion pounds of milk equivalents</u>									
Quantities:									
Production	124.2	117.0	115.4	126.5	135.5	139.7	135.4	143.7	144.1
Farm use	6.0	4.0	3.1	2.3	2.4	2.4	3.0	2.5	2.6
Marketings	118.2	113.0	112.3	124.2	133.1	137.3	132.4	141.2	141.5
Manufactured products for commercial use ^{1/}	57.1	55.2	59.2	64.5	69.5	70.8	73.2	76.0	79.4
Fluid products	55.4	52.0	51.1	50.9	49.3	49.7	50.6	52.0	51.5
CCC purchases	5.7	5.8	2.0	8.8	14.3	16.8	8.6	13.2	10.6
<u>1,000 cows</u>									
Production factors:									
Cows	14,953	12,000	11,140	10,779	11,011	11,098	10,840	11,025	10,839
<u>Pounds per cow</u>									
Production per cow	8,305	9,747	10,352	11,875	12,306	12,585	12,495	13,031	13,293
<u>Ratio</u>									
Milk/feed price ratio ^{2/}	1.18	1.53	1.31	1.48	1.53	1.45	1.41	1.51	1.79
<u>Dollars per hundredweight</u>									
Prices: ^{3/}									
Support	3.71	4.28	7.24	12.33	13.10	13.06	12.60	11.73	11.60
Manufacturing milk	3.34	4.70	7.63	12.00	12.66	12.63	12.47	11.72	11.46
Grade A milk	4.63	6.05	9.02	13.20	13.73	13.72	13.58	12.88	12.64
All-milk	4.23	5.71	8.75	13.00	13.59	13.57	13.45	12.73	12.51

^{1/} Marketings in manufactured products for commercial use.

^{2/} Pounds of 16-percent ration equal to 1 pound of milk.

^{3/} Prices at national average milkfat test.

Source: (29).

Production

Production per cow is an important indicator of productivity in the dairy sector. Annual production per cow increased 60 percent from 8,305 pounds of milk in 1965 to 13,293 pounds in 1986 (table 3). This increase reflects genetic changes toward more productive dairy cattle, higher rates of concentrate feeding, better nutrition and herd management skills of farmers, and other technological advances on farms, all generally encouraged by increased profitability of dairy production.

Increasing profitability as measured by higher milk/feed price ratios reversed a long downward trend in cattle numbers in 1982. Cow numbers increased from the year earlier in both 1982 and 1983 (table 3). Cow numbers declined in 1984, rose in 1985, and fell again in 1986. The recent diversion and dairy termination programs contributed to the declining cow numbers. These programs provided the opportunity for some producers to leave the industry. The dairy diversion program reduced milk supplies about 9.4 billion pounds from January 1984 to March 1985. The dairy termination program was primarily responsible for reducing milk supplies by 12.3 billion pounds from April 1986 through August 1987.

Annual milk production and marketings increased steadily in 1975-86, except for 1984. These increases reflect, except for the effects of the diversion in 1984, the favorable milk/feed price relationship over this timeframe despite declining milk prices (table 3). Given the possibility, under current legislation, of support prices declining further to as low as \$9.60 by 1990, any major increases in milk production or investments in dairy farming in the next few years will likely result from improved herd management, changes in input prices, new technology such as increased genetic capability expected in feed grain and forage production, the increased rate of genetic improvement in dairy cattle resulting from biotechnology, and the use of bovine Somatotropin growth hormone.

Utilization of Marketings

The utilization of marketings indicates trends in commercial uses of milk in fluid and manufactured products and trends in CCC purchases of surplus dairy products. Table 3 reports USDA figures for milk equivalents used in fluid products and CCC purchases, and subtracts these categories from marketings to arrive at the milk equivalents used in manufactured milk products purchased commercially.

Fluid milk use declined from 55.4 billion to 49.7 billion pounds from 1965 through 1983 (table 3). Use increased in 1984 and 1985 before decreasing again in 1986. Milk used to produce manufactured dairy products increased steadily from 55.2 billion to 69.5 billion pounds (milk-equivalent basis) from 1970 through 1982, leveled off between 1982 and 1983, and then increased steadily to 79.4 billion pounds in 1986 (table 3). During this period, milk used in fluid milk products decreased (on a milk-equivalent basis) from 55.4 billion to 51.5 billion pounds.

CCC purchases increased from 2 billion to 8.8 billion pounds of milk equivalent between 1975 and 1980, and nearly doubled to 16.8 billion pounds by 1983 (table 3). Lower purchases in 1984, partially due to the dairy diversion program, preceded an increase to 13.2 billion in 1985. CCC purchases declined to 10.6 billion pounds in 1986.

CHAPTER 3: CONSUMPTION TRENDS

Per capita consumption, excluding donations, of dairy products increased an average of 2 percent per year from 1983-86 after declining from 1965-74 and stabilizing until the early 1980's. Increases in per capita cheese consumption, primarily in the away-from-home market, contributed the most to this increase. Consumption of fluid milk rose slightly after a long decline but not enough to change consumption of total dairy products significantly. Per capita consumption of the other dairy products stabilized or showed modest gains. But modest gains in categories such as evaporated, condensed, and dry milk contributed little to expanding the per capita total because of their small share of the total. Dairy's share of the at-home food budget remained fairly stable during 1980-84 at about 13 percent. The proportion of the budget spent on cheese, butter, and whole milk declined but was offset by increases for other fresh milk products, ice cream and related products, and other dairy products.

This section of the report reviews disappearance trends for aggregate dairy products and for individual products to provide a historical context for analyzing 1980's movements in consumption. As indicated in the box on consumption data, disappearance data measure the total quantity available for use for food after adjusting for changes in stocks, trade, and nonfood uses (table 4). Domestic disappearance is analyzed on a per capita basis and is shown with and without donations for all dairy products from 1977 and for individual products when the donation data are available.

Disappearance data do not provide details on how family characteristics affect consumption. Therefore, expenditure data from the 1980-84 Bureau of Labor Statistics' (BLS) Continuing Consumer Expenditure Survey (CCES) are used to evaluate per capita expenditures for dairy products consumed at home. We also examined changes in the relative shares of the consumer budget allocated to dairy products from 1980 to 1984 (see boxes on at-home spending and consumption data). Product expenditures were divided by a corresponding price index to obtain a measure of the quantities consumed.

TRENDS IN DAIRY PRODUCT CONSUMPTION

Consumption of dairy products measured on a milk-equivalent milkfat basis and including donations increased sharply in the 1980's from 12.3 billion pounds to 14.2 billion pounds (table 4). Consumption rose steadily in 1974-81 after declining roughly 0.5 percent per year in 1965-74 (fig. 4). Consumption continued to increase at an average rate of 3.3 percent per year from 1981-84 before slowing to a 1-percent growth in 1985-86. But some of this increase resulted from expanded donations. While consumption rose, stock levels also grew rapidly from 8.6 billion pounds in 1980 to 22.6 billion pounds by January 1, 1984, and put added pressure on donation programs.

Although consumed, dairy product donations are not purchased in the market and their exclusion from the disappearance data provides a better indication of how consumer purchases have changed (fig. 4). In 1965-74, the annual drop in consumption, excluding donations, averages closer to 0.25 percent than the

Table 4--Supply and utilization of all dairy products 1/

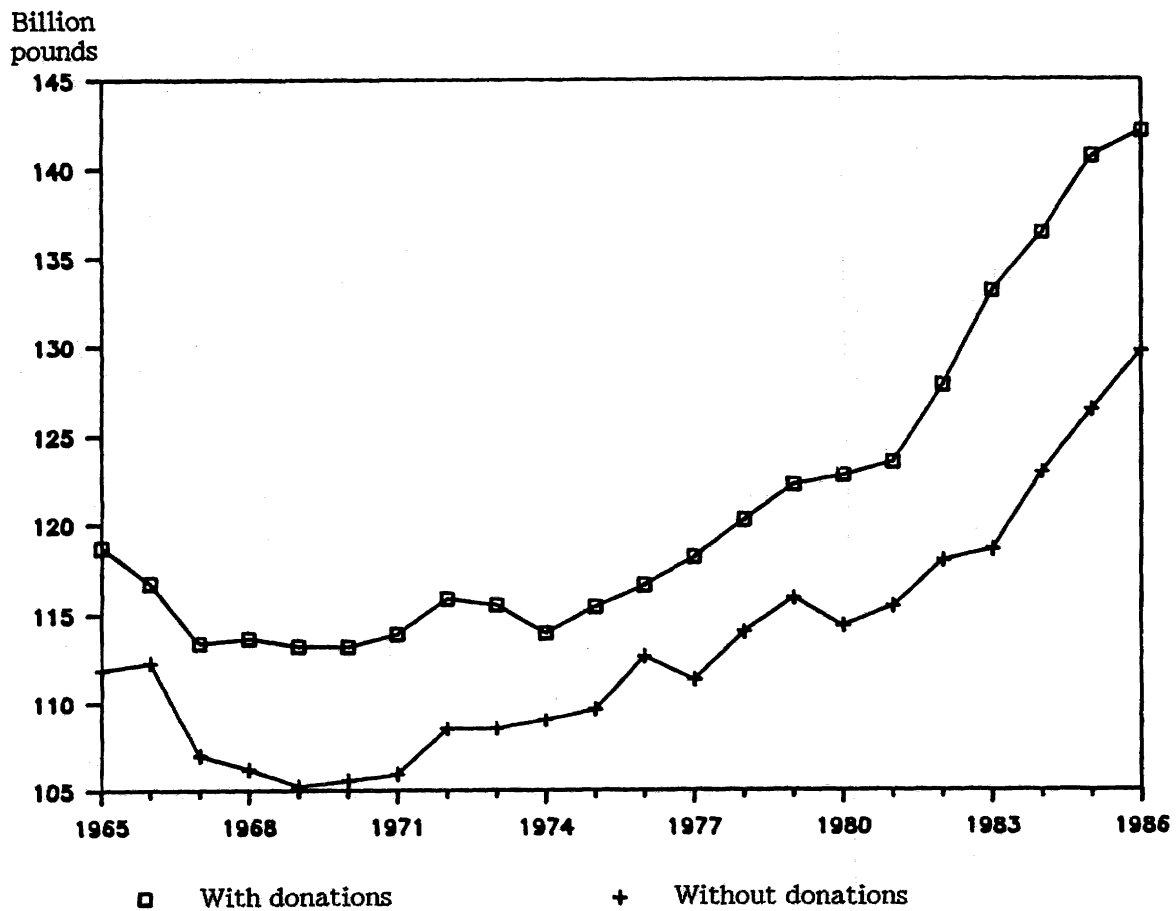
1/ Milk-equivalent, milkfat basis.

3/ Government and commercial.

5/ Preliminary.

17

Figure 4—Civilian consumption of dairy products 1/



1/ Total dairy products on a milk-equivalent, milkfat basis.

Civilian consumption of total dairy products rose sharply in the early 1980's.

This dairy product consumption picture changes again when described in per capita terms using July 1 estimates of the U.S. civilian population. While total consumption fell less than 0.5 percent per year during 1965-74, consumption per capita decreased on average 1.5 percent per year (fig. 5). Per capita consumption excluding donations increased in 1983 after generally falling from the mid-1960's through the early 1980's. Per capita consumption including donations increased 0.1 percent during 1974-81 while per capita consumption excluding donations dropped 0.25 percent.

This declining trend for per capita consumption without donations continued to 1983 while per capita consumption including donations shows a sharp upward trend beginning in 1981. Per capita consumption excluding donations increased at an average annual rate of about 2.1 percent in 1983-86 while per capita consumption including donations increased about 1.3 percent. Moreover, per capita consumption including donations remained almost unchanged in 1985-86. Excluding donations, per capita consumption increased more than 1.6 percent in 1985-86.

Because trade in dairy products is limited, imports and exports have minimal impact on the per capita dairy product total (table 4). As a percentage of total disappearance, imports ranged from a low of 0.7 percent to a high of 3.2

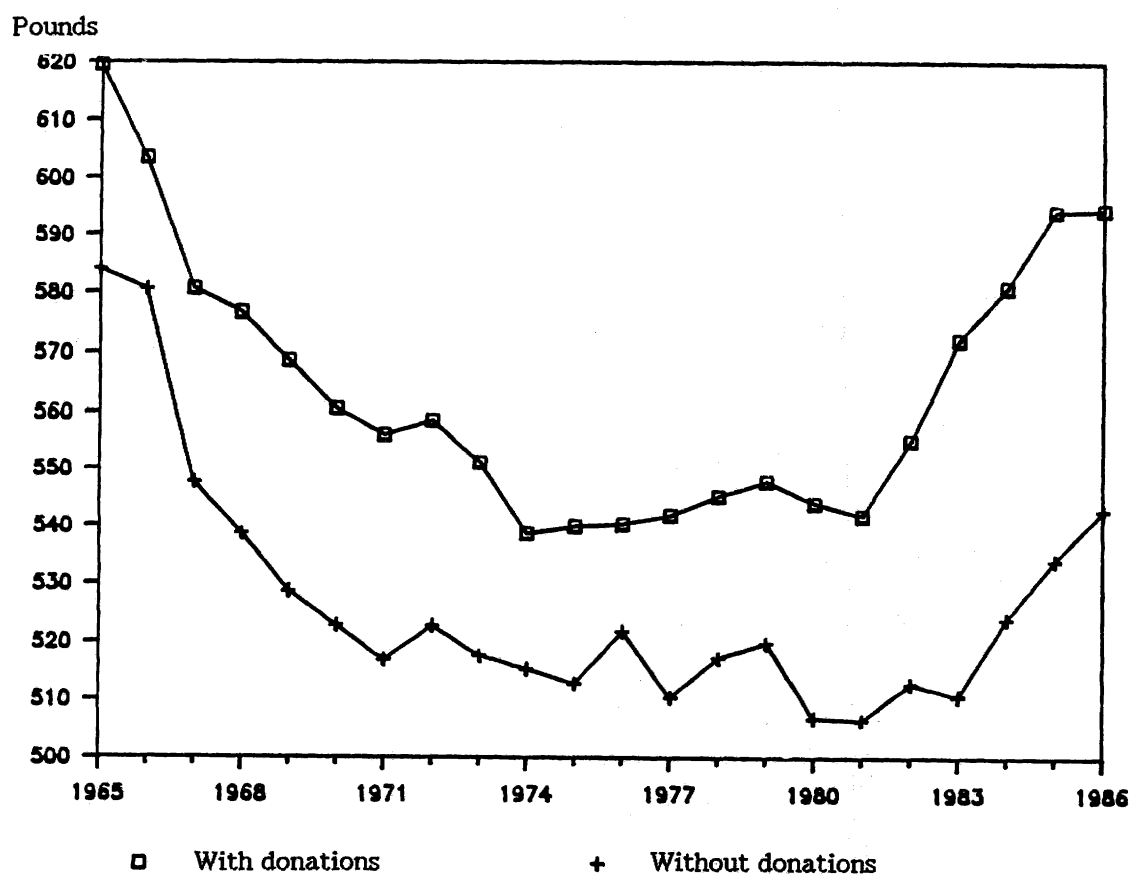
Consumption Data

We examined consumption of dairy products by analyzing USDA time-series data on supply and utilization of dairy products (table 4). The sum of production, beginning stocks, and imports constitutes the supply (quantity) available for use (utilization). Utilization consists of exports, food and nonfood use, and ending stocks. Some of these categories may be further broken down, depending on the commodity and the particular use. For example, utilization for food, called food "disappearance," is often separated into military and civilian disappearance; stocks may be comprised of commercial and Government holdings. Civilian disappearance divided by civilian population yields per capita civilian disappearance, or per capita civilian consumption. In most cases, food disappearance is the residual after accounting for production, stock changes, and net trade. The supply side of the ledger, therefore, will always balance with the utilization side.

Consumption changes may actually stem from fluctuations in production, especially for commodities where trade is minimal and where stocks represent a small share of total supply (such as meat, fresh vegetables, and fruit). Fluctuations in food disappearance, by themselves, do not indicate that demand has changed. Demand changes only when the quantity demanded changes due to changes in prices or other factors affecting consumer demand.

Although this report is based primarily on USDA disappearance data, we also incorporated information on household expenditures from other sources, such as household surveys, to analyze demand. Details of their characteristics are discussed later.

Figure 5—Per capita consumption of total dairy products 1/



1/ Total dairy products on a milk-equivalent, milkfat basis.

Excluding Government donations from per capita consumption shows that consumption rose from 1983 through 1986.

percent over the last 20 years. Exports were also limited and fluctuated from a low of 0.3 percent to a high of 3.7 percent (fig. 6). Subtracting annual imports from annual exports to measure net trade indicates that imports exceeded exports in most of the last two decades and by as much as 3.2 billion pounds in 1973. However, exports exceeded imports from 1981 through 1985.

These aggregate dairy product statistics are useful for evaluating total milk utilization. But consumers purchase and use individual dairy products. The following section shows how consumption trends differ substantially across the individual dairy product categories.

Cheese

The consumption pattern for cheese (excluding cottage cheese) contrasts sharply with other dairy products. Cheese is one of the few dairy products whose per capita consumption rose steadily, more than doubling over the last two decades. Per capita cheese consumption rose an average of 4.2 percent from 9.8 pounds in 1966 to 23.2 pounds in 1986. Throughout this period, per capita consumption declined only once--a decrease of a little over 0.1 pound in 1974-75 (fig. 7).

Cheese donations increased significantly during the early 1980's. Donations accounted for more than 10 percent of 1983 per capita consumption. But total per capita cheese consumption continued its rise in the 1980's, at or near the pre-1981 trend, even with donations factored out.

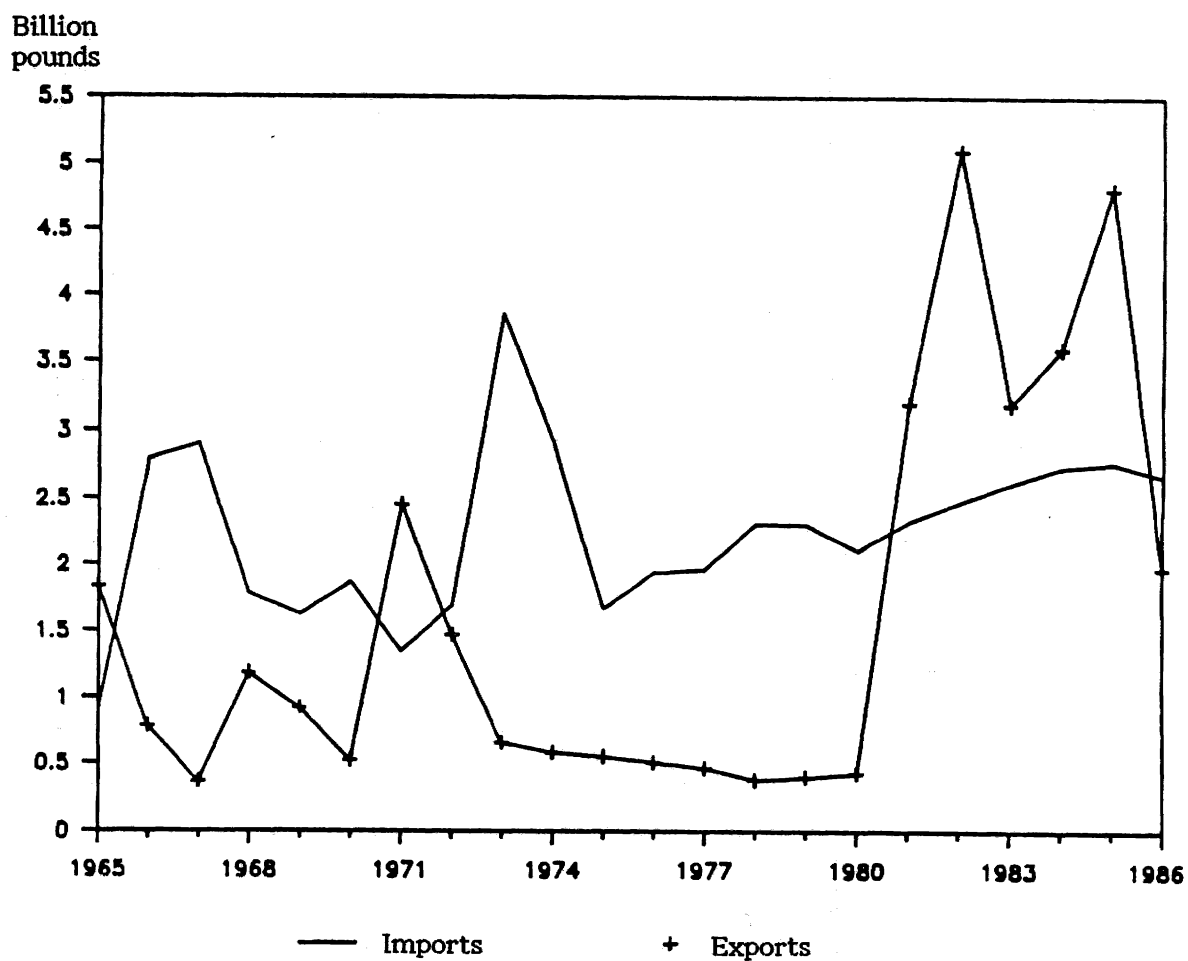
Consumption of American-type cheese, the largest component of the cheese total, increased 3.5 percent per year from 6.2 pounds per person in 1966 to 12.2 pounds in 1985 but slipped to 12.1 pounds in 1986 (fig. 7). Donations of American cheese increased significantly in the early 1980's, especially in 1983-86. However, consumption of American cheese still increased after donations are excluded, at about the pre-1980's rate of growth.

Per capita consumption of Italian-type cheese increased an average of 8 percent per year from about 1.5 pounds per capita in 1966 to over 7 pounds in 1986. Donations constituted a small portion of Italian cheese, averaging about 0.12 pound per capita per year during 1980-86. Miscellaneous cheese consumed per capita doubled from about 2 pounds in 1966 to about 4 pounds in 1986, averaging about a 3.6-percent increase per year.

Fluid Milk and Cream

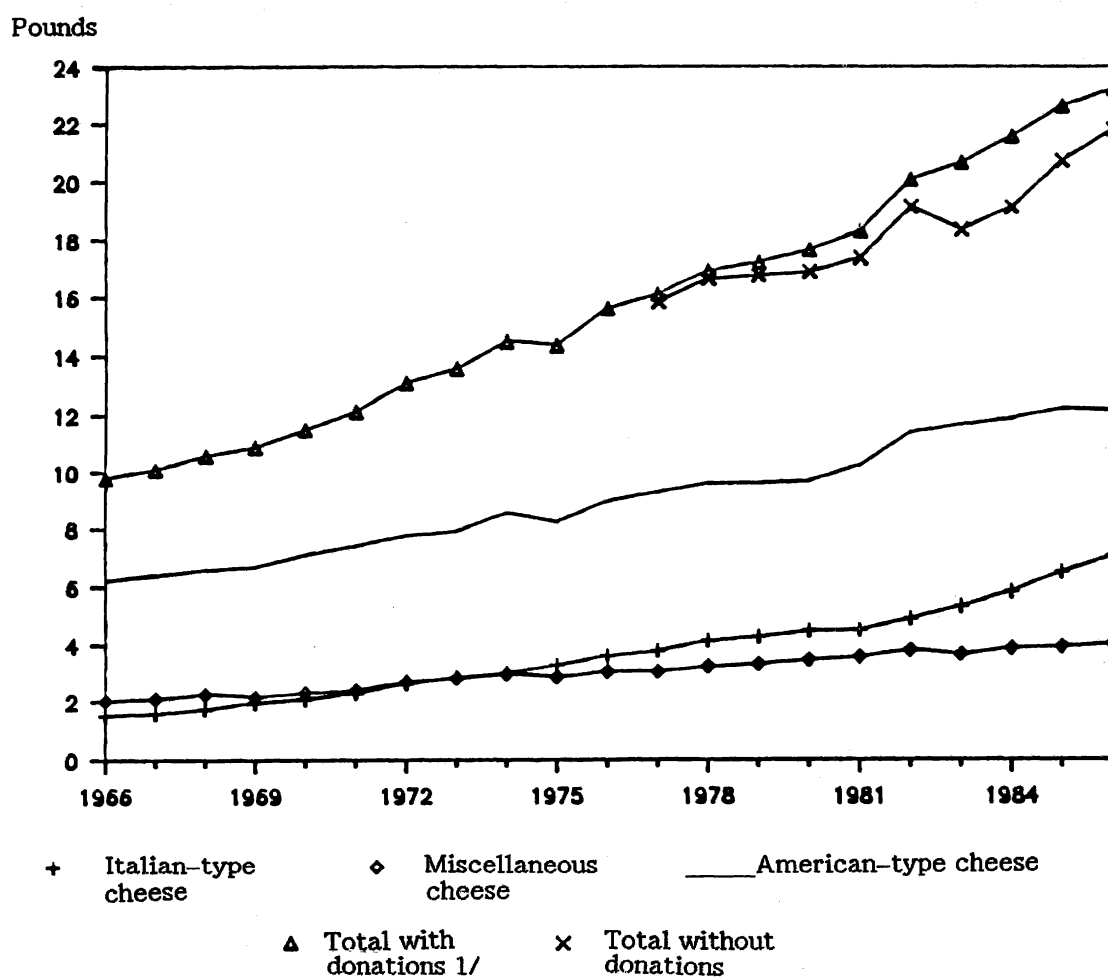
Although per capita fluid milk consumption increased in 1983-86, the 3.5-pound increase was only large enough to push consumption back up to the 1981 level of 245 pounds (fig. 8). Per capita consumption of fluid milk and cream declined steadily from 292 pounds in 1965 to 242 pounds in 1982, or slightly less than 1 percent per year. But this slow decline in fluid milk and cream products masks rather significant changes in its components: lowfat milk is steadily replacing whole milk. Per capita consumption of whole milk declined about 3 percent per year from 246 pounds in 1965 to 118 pounds in 1986. Other milk, mostly lowfat milk, increased at an average annual rate of over 5 percent, from 39 pounds per capita in 1965 to over 119 pounds in 1986. Changes in fluid milk and cream consumption are important contributors to aggregate dairy product consumption since fluid use represented 36 percent of total 1985 marketings, milk-equivalent basis.

Figure 6—U.S. trade in total dairy products



U.S. trade in dairy products varied widely, but exports exceeded imports from 1980 to 1985.

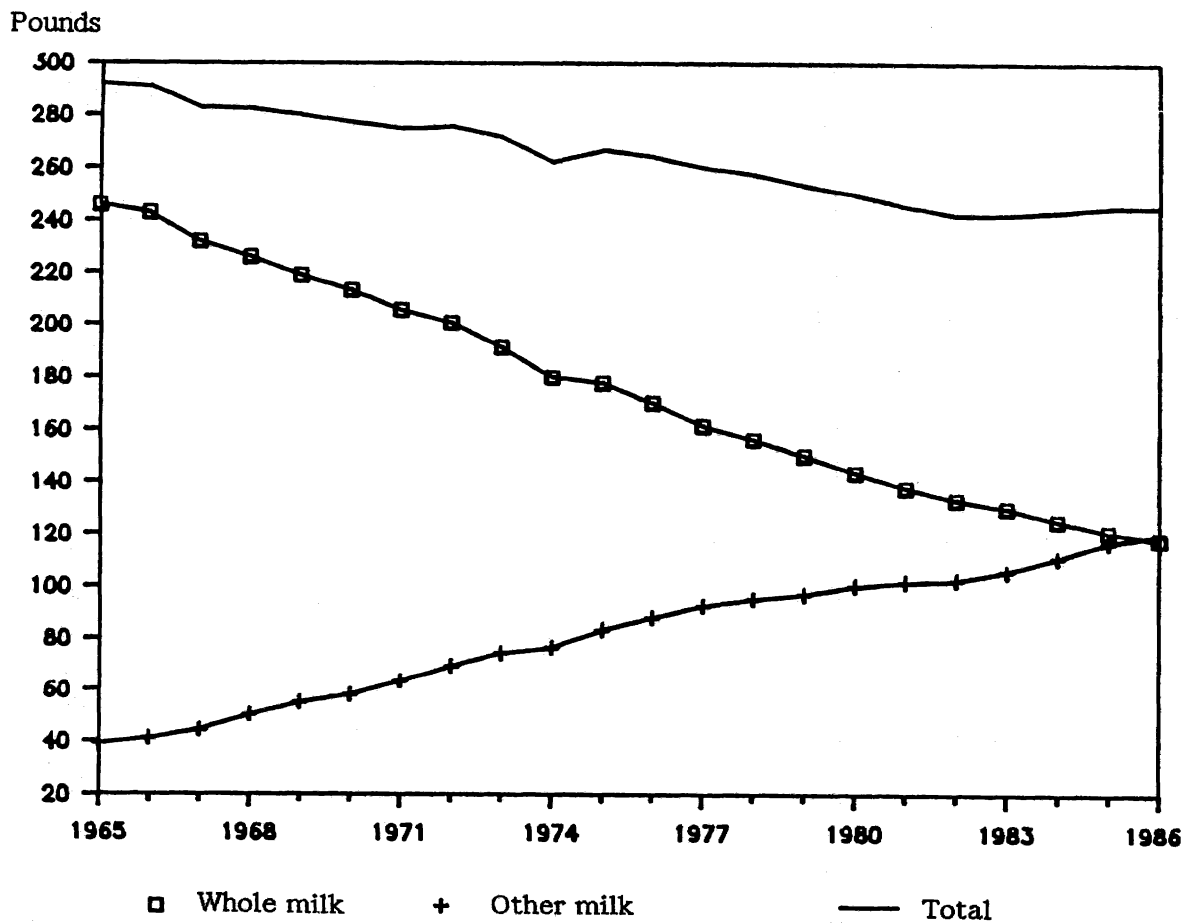
Figure 7--Per capita consumption of cheese



1/ Data on donations of individual dairy products were not available prior to 1977.

Most of the increase in per capita consumption of dairy products is attributable to the continued rise in cheese consumption.

Figure 8—Per capita consumption of fluid milk and cream 1/



1/ Includes donations.

Fluid milk and cream increased slightly, after long declines. Consumption of lowfat milk has steadily replaced whole milk.

Fluid milk consumption hit a low of 241.9 pounds per capita in 1982, increased to 245.1 pounds in 1985, and did not change in 1986. Cream and specialty products (included in the total but not shown separately in fig. 8) decreased from about 7 pounds per capita in 1965 to a low of 5.3 pounds in 1971 before increasing slowly back to about 7.5 pounds in 1986.

Despite the recent increase, per capita fluid milk consumption has declined over the long run even with lowfat products substituted for whole milk products (fig. 8). Whether or not the last few years represent a leveling off in fluid milk consumption or a change in direction is, at this point, unclear. It should be noted that the fluid milk and cream data include donations and food assistance quantities.

Butter

Per capita consumption of butter, excluding donations, has stabilized at about 4 pounds per person after posting small increases in 1977-79 (fig. 9). Based on unpublished data, butter donations doubled in 1983, remained at about that level until 1985, and then dropped slightly in 1986 (fig. 9).

Evaporated, Condensed, and Dry Milk Products

Per capita consumption of condensed, evaporated, and dry milk products declined from 1965 to 1980-81, leveled off, and then increased slightly through 1986 (fig. 10). Consumption of evaporated and condensed milk products declined about 3 percent per year, from about 16 pounds in 1965 to a low of about 7 pounds in 1980 where it remained until 1984 before increasing to 7.9 pounds in 1986. Consumption of dry milk products declined slowly (less than 1 percent) from about 7 pounds in 1965 to a low of 5.6 pounds in 1981-82. Per capita consumption rose to 7.2 pounds in 1986. Without donations, consumption would have increased to 6.6 pounds.

Frozen Dairy Products

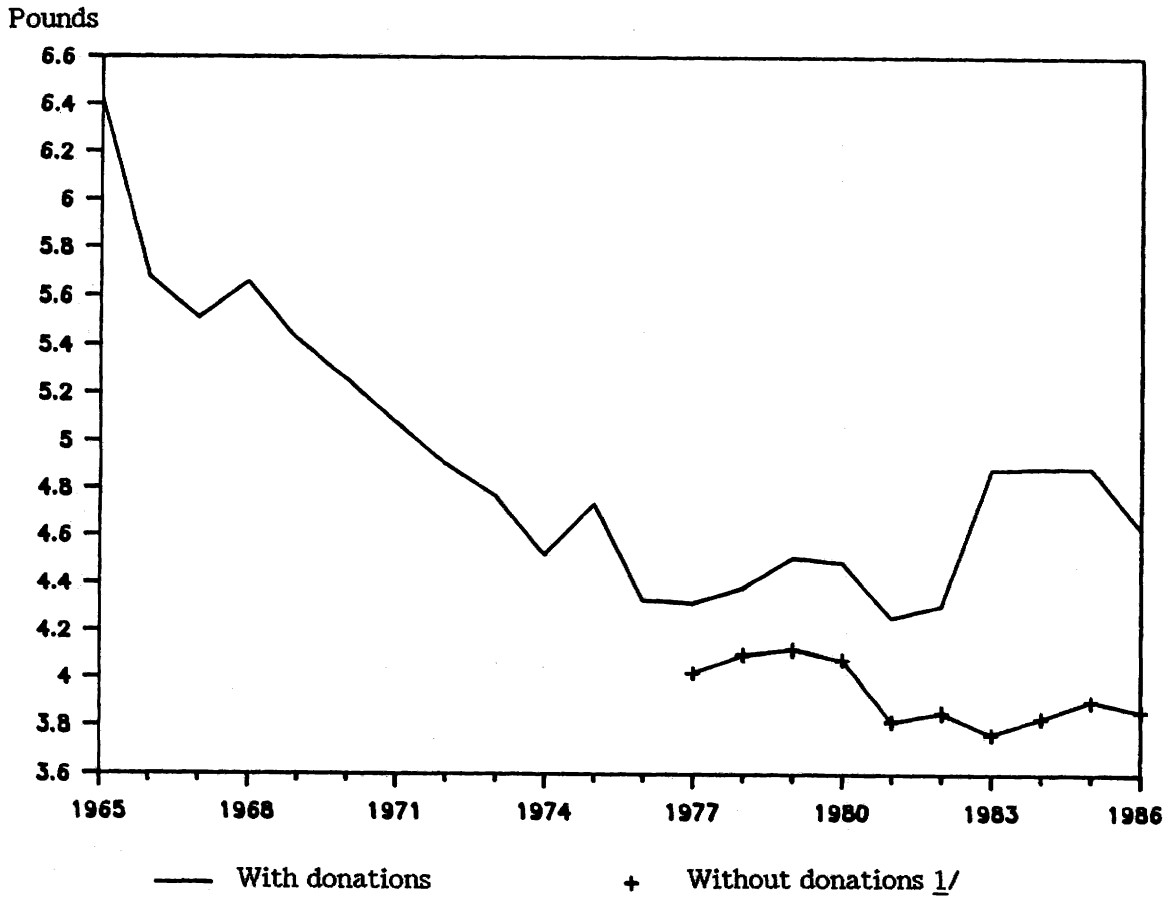
Per capita consumption of frozen dairy products has been relatively stable at 27 to 28 pounds during 1965-86 (fig. 11). Per capita consumption of ice cream remained relatively stable during 1965-86, varying less than 1.5 pounds per year. People consumed about 18.5 pounds of ice cream in 1965. Consumption dropped slightly to 17.3 pounds per person in 1972, returned to 18.5 pounds in 1975, gradually dropped to 17.1 in 1979, and returned to 18.3 pounds in 1986.

Other frozen dairy products have a similar per capita consumption pattern, but at only about half the quantity of ice cream (fig. 11). Although both product categories showed higher per capita consumption in 1986, there is little evidence to indicate a change in the historic pattern of per capita consumption, given the small magnitude of variation during 1965-86.

AT-HOME AND AWAY-FROM-HOME DAIRY PRODUCT CONSUMPTION

This section uses food expenditure data from several sources to supplement physical disappearance data in analyzing differences in at-home and away-from-home consumption patterns. Expenditures for specific products were divided by a corresponding price index to obtain a measure of the quantities

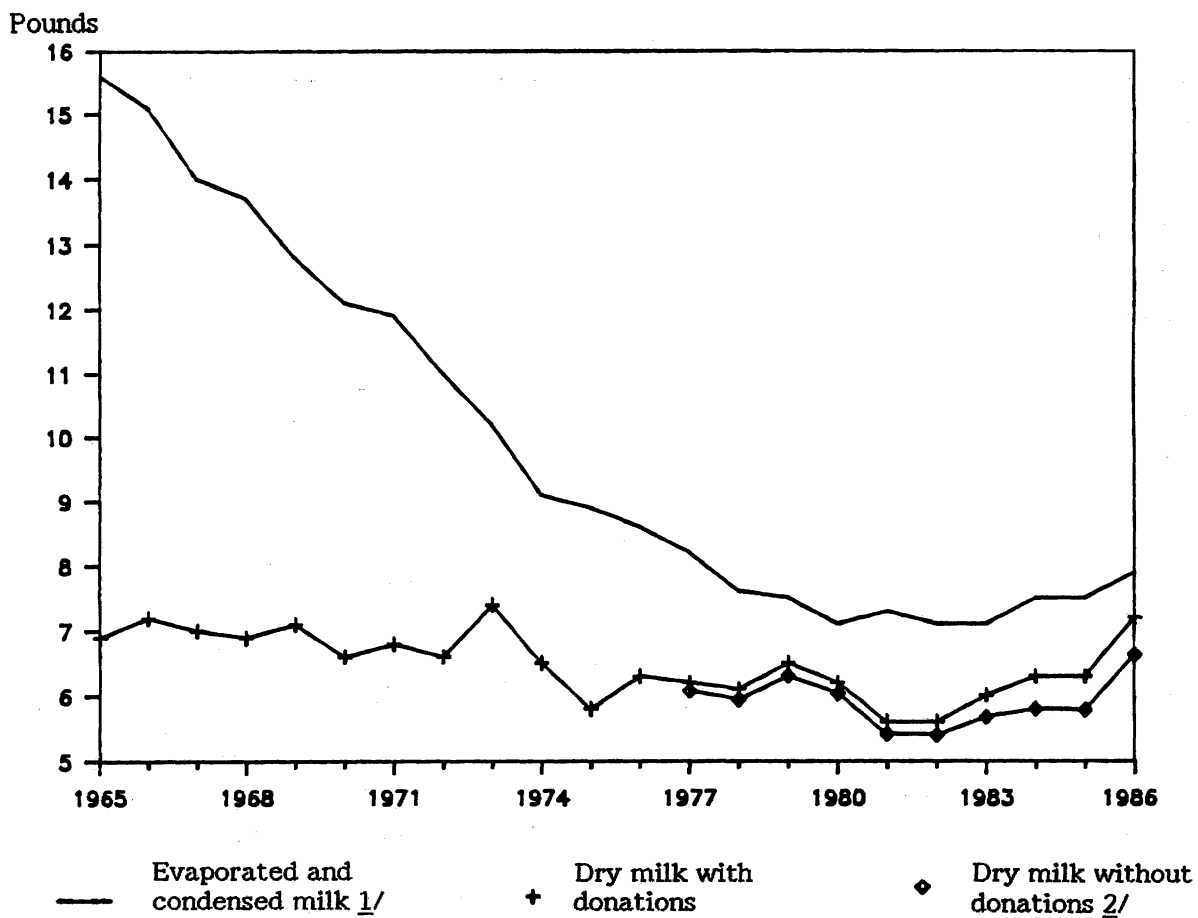
Figure 9—Per capita consumption of butter



1/ Data on donations of individual dairy products were not available prior to 1977.

Recent increased donations raised butter consumption. Without donations, consumption levels out.

Figure 10--Per capita consumption of evaporated, condensed, and dry milk

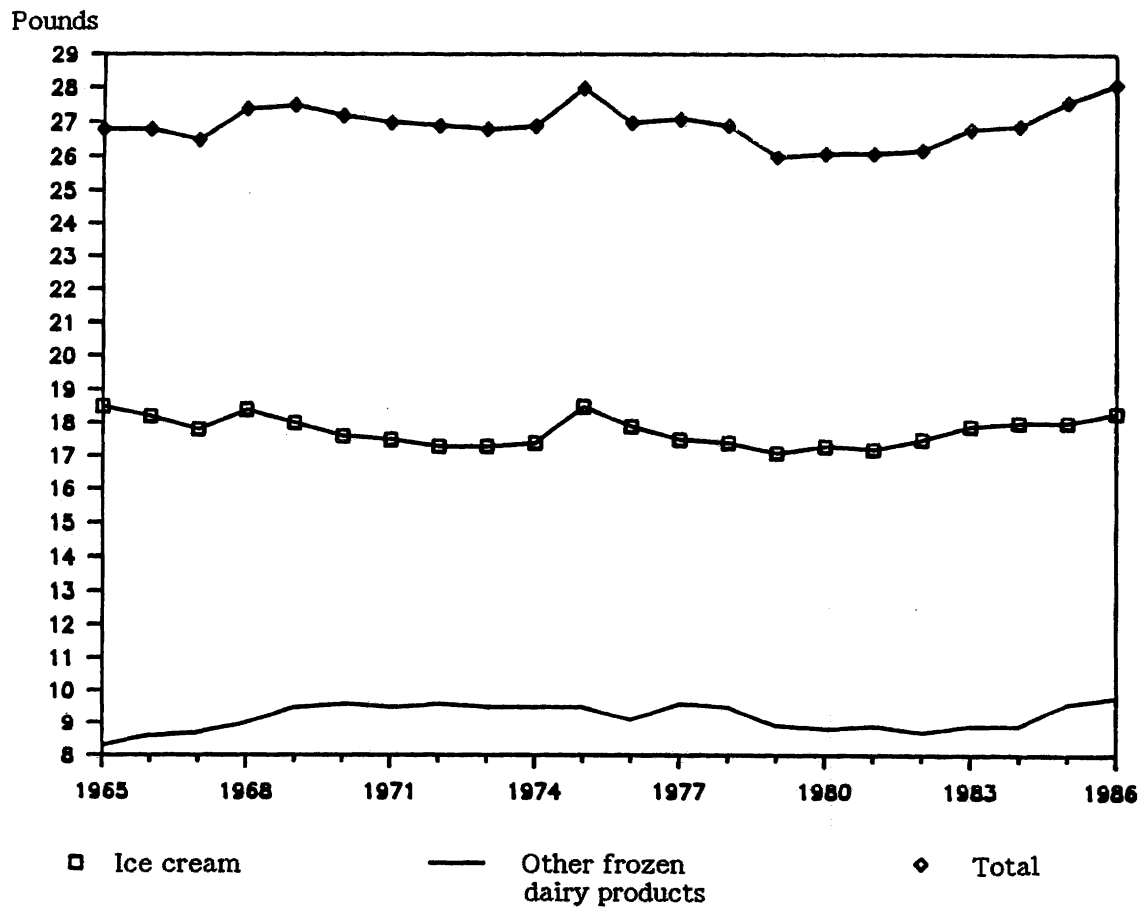


1/ Includes donations.

2/ Data on donations of individual dairy products were not available prior to 1977.

Consumption of evaporated, condensed, and dry milk rose.

Figure 11—Per capita consumption of frozen dairy products



Consumption of frozen dairy products shows little variation.

consumed. The expenditure data indicate that per capita consumption of total dairy products at home in 1984 was essentially equal to 1980 levels. Between those years, consumption increased 4.5 percent from 1980 to 1982 before falling back to the 1980 level over the next 2 years (table 5).

At-home consumption of many individual dairy products increased between 1981 and 1982. At-home per capita consumption of fresh milk and cream rose in 1981 and 1982 before falling from 1982 to 1983. Fresh milk and cream consumed at home rose slightly between 1983 and 1984, but remained 2.4 percent below 1980 levels. Per capita consumption of fresh whole milk declined 12.4 percent from 1980 to 1984, while other fresh milk and cream products (mostly lowfat products) rose about 13 percent (table 5).

At-home per person cheese consumption fell from 1980 levels in all years except 1982. By 1984, per capita at-home consumption of cheese was 6.8 percent below 1980 levels (table 5). Other dairy products, the catch-all category, showed strong growth between 1983 and 1984, but at-home consumption was below 1980 levels in most years. Butter consumption per person at home also rose in 1982 from 1980 levels, but fell considerably below 1980 levels in 1983 and 1984.

Budget Shares

At-home consumption of dairy products and the share of the total at-home food budget allocated to dairy products has remained fairly stable since 1980. Total per capita at-home consumption declined in 1980-84 for all dairy products except other fresh milk and cream products (mostly lowfat milk), ice cream and related products, and other dairy products. The decline in at-home

Table 5--Deflated weekly per capita at-home expenditures indexed to 1980

Products	Expenditures in--			
	1981	1982	1983	1984
	<u>Percent of 1980 levels (1980=100)</u>			
Food at home	98.7	98.9	97.4	97.4
Total dairy products	98.9	104.5	99.6	99.5
Fresh milk and cream	100.9	104.4	97.5	97.6
Fresh whole milk	94.6	102.7	88.4	87.6
Other	107.7	106.8	111.3	113.0
Cheese	96.3	103.4	99.8	93.2
Ice cream and related products	94.9	102.2	109.5	115.6
Other dairy products	92.8	90.2	98.5	106.4
Butter	92.9	102.2	89.8	87.6

Sources: (34, 35), and computations by authors.

per capita cheese consumption may appear somewhat surprising. But 1982-85 data from MRCA on cheese show the same pattern. The trend in the percentage of households reporting purchases of dairy products (as indicated by the CCES data) tends to confirm the trends in per capita consumption.

Dairy's share of the at-home food budget remained fairly stable during 1980-84, at about 13 percent (table 6). Other fresh milk products, ice cream and related products, and other dairy products gained larger shares, while

At-Home Spending and Consumption Data

We supplemented disappearance data with information from household surveys to obtain additional insight on at-home consumption of dairy products and the factors influencing at-home demand. In using the following data, we assumed that relative prices remained constant within a survey.

TABLE 1

Nationwide Food Consumption Survey (NFCS). The 1977/78 NFCS, the most recent of six USDA national household food consumption surveys (the others were conducted in 1935/36, 1942, 1948, 1955, and 1965/66), gave information on household characteristics and food use. The NFCS accounts for the value of all food products consumed at home, regardless of whether the items were purchased at the retail level, or obtained through home production or gifts. The sample, representative of households in the 48 contiguous States, contains information on household socioeconomic characteristics and the types and amounts of foods consumed. The survey has two parts: a week's listing of food used at home and a record for each member. The week's listing of the kinds, quantities, values, and sources of food used from home supplies--the household portion of the survey--provided the basis for most analyses. The individual record for each household member listed the kinds and quantities of food consumed, both at and away from home. The cross-sectional data for the survey were collected for a year, beginning in April 1977 and ending in March 1978. The NFCS's large sample size and great diversity of household characteristics allows us to measure the relationship between these characteristics and at-home dairy expenditures.

The NFCS surveyed, through personal interviews, the household member most responsible for purchasing and preparing food. The households were contacted at least a week before the interview and asked to keep unstructured notes on food use and expenditures to assist them during the interview. Trained interviewers used a detailed list to help the respondents recall information on the kinds, quantities, values, and sources of food used from home supplies during the week immediately preceding the interview. Foods were measured in the form they entered the household. Our analysis excluded households using nonpurchased dairy foods such as those produced at home or received through donations, programs for the elderly, gifts, or pay because their demand responses usually differed from households buying only in the retail market. Data on foods consumed away from home were not collected in this part of the survey and were, therefore, also excluded.

Bureau of Labor Statistics (BLS) Continuing Consumer Expenditure Survey (CCES). An annual survey, the CCES contains the most recent (1980-84) and comprehensive data available on food spending in American households. The CCES records only items that households purchased for use at home during the survey period. For example, if a household only consumed food already in stock and purchased no foods, the household expenditure for

cheese, butter, and whole milk lost shares. The share of the dairy budget allocated to fresh whole milk and cheese declined 4.7 and 1 percent, respectively, between 1980 and 1984. The share of the budget rose 2.6 percent for ice cream and related products and over 0.5 percent for other dairy products.

Table 7 shows the portion of urban households that reported purchasing dairy products during 1980-84. These percentages may seem low, but recall that the

food was zero. For the entire 1980-84 period, the CCES contains data on urban households. The CCES includes two components, each with its own questionnaire and sample: an interview panel that surveyed about 5,000 households every 3 months over a 1-year period, and a diary survey of approximately the same sample size in which households kept an expenditure diary for 2 consecutive weeks. The interview panel survey obtains data for relatively large and infrequently purchased items, such as those for real property, automobiles, and major appliances that respondents can typically recall over a 3-month period.

In contrast, the diary survey obtains data for small, frequently purchased items that are normally difficult to recall, such as foods, beverages, tobacco, housekeeping supplies, nonprescription drugs, personal care products, services, and fuels. The diary survey excludes expenditures incurred when away from home, for overnight or longer.

Market Research Corporation of America (MRCA).* MRCA data give detailed information on household dairy purchases: the brand of the item purchased, the type or flavor, size of package, number of packages bought, price, type of store purchased at, and any coupons or sales incentives. MRCA's National Consumer Panel is a weekly mail diary panel of 7,500 households nationwide. Panelists represent demographic classifications such as race, age, and household size, and geographic classifications such as rural, suburban, and urban. The panel is maintained continuously over time, with new panelists selected for similar demographic characteristics to minimize the effect of attrition on data quality.

Each panel household completes and returns a diary to MRCA weekly for timely data collection and aggregation. Monthly or quarterly reports are available, based on specific categories of interest to the client. The National Dairy Promotion and Research Board supplied the MRCA data we used.

Marketscore Data.* The primary service offered by Foodservice Research and Marketing (FR&M), Marketscore is the basis for data on food products used away from home. From a 1986 telephone survey of 1,000 restaurants of all types across the Nation, this survey provides the most representative sample of U.S. restaurants and avoids geographic or restaurant-type biases. The National Dairy Promotion and Research Board may contract with FR&M to periodically repeat the survey. The data reflect restaurants and institutions across the United States, segmented by type. The data provide category, volume, and share of the market for any given food products. The National Dairy Promotion and Research Board also supplied the Marketscore data used in this report.

* This section taken largely from Forker, Liu, and Hurst (5).

Table 6--Dairy products' share of the at-home food budget

	Dairy's share of food expenditures				
Budget items	1980	1981	1982	1983	1984
Dairy spending as a share of at-home food budget	13.3	13.3	13.7	13.3	12.9
Product spending as a share of total dairy budget:					
Fresh milk and cream	52.4	52.8	51.3	50.0	50.0
Fresh whole milk	32.4	30.6	31.1	28.0	27.7
Other	20.0	21.7	20.2	22.0	22.3
Cheese	27.6	27.2	30.0	28.5	26.6
Ice cream and related products	11.2	11.1	11.4	12.9	13.8
Butter	4.7	4.4	4.7	4.3	4.3
Other dairy products	4.7	4.4	4.1	4.8	5.3

Source: (35).

Table 7--Percentage of urban households purchasing dairy products

		Urban households purchasing dairy products in--				
Dairy products		1980	1981	1982	1983	1984
				Percent		
Total dairy products		77.1	78.9	77.3	76.9	77.1
Fresh milk and cream		69.9	72.3	70.2	70.0	69.9
Fresh whole milk		50.7	51.7	50.2	47.4	46.3
Other fresh milk and cream		41.7	44.8	43.3	43.5	43.6
Cheese		42.1	42.3	40.4	39.5	39.5
Ice cream and related products		23.7	24.4	24.0	24.2	25.7
Other dairy products		17.0	17.6	16.9	16.8	17.7

Source: (35).

CCES data, the source for this table, is an expenditure survey, not a consumption survey. The share of households purchasing total dairy products remained relatively stable in 1980-84, averaging about 77 percent. The share varies more for individual dairy products.

The percentage of households purchasing dairy products generally mirrors the per capita consumption trends presented earlier. Households purchasing fresh whole milk declined from 50.7 percent in 1980 to 46.3 percent in 1984, while households purchasing other fresh milk and cream products increased from 41.7 percent in 1980 to 43.6 percent in 1984. The share of households purchasing cheese for at-home consumption declined from 42.1 percent in 1980 to 39.5 percent in 1984, resulting partially from increased donations starting in 1981. Households purchasing ice cream and related products rose from 23.7 percent in 1980 to 25.7 percent in 1984.

Expenditure Patterns

The CCES and MRCA data are measures of at-home consumption; USDA disappearance data measure total consumption; and Marketscore data give information on away-from-home use. Used together, these data allow inferences to be made concerning growth patterns in the three markets. Combining information from the CCES surveys, disappearance data, Marketscore data, and MRCA data implies:

- o Per capita at-home consumption of total dairy products appeared relatively constant in 1980-84 (except for 1982). If this trend held in 1985 and 1986, the growth in total per capita dairy product consumption as indicated by the USDA disappearance data would appear to be centered on away-from-home consumption and in the use of dairy products as ingredients in processed foods.
- o Per capita consumption of cheese declined in the at-home market in 1980-85 (except for 1982). Therefore, per capita consumption of cheese grew faster in the away-from-home and ingredient use markets than at home in 1982-86. MRCA data show that national at-home cheese consumption increased about 3 percent in 1986 over 1985 levels, mostly in processed cheeses. However, total commercial disappearance rose 5.7 percent between 1985 and 1986. Marketscore data show that about 37 percent of cheese is consumed at home, 39 percent away from home, and 24 percent as ingredients.
- o All of the recent increases in per capita butter consumption can be attributed to butter consumed in the away-from-home market and as ingredients. Per capita consumption of butter fell in the at-home market in the early 1980's, according to the CCES data. MRCA data also indicate that per capita at-home butter consumption fell in 1985 and 1986. Therefore, butter consumed away from home and as ingredients in processed foods increased. Marketscore data indicate that 30 percent of butter is consumed at home, 43 percent away from home, and 27 percent for other purposes.
- o Per capita at-home consumption of fresh fluid milk rose in 1981 and 1982 over 1980 levels and fell to reach a low in 1983, with a slight upturn noted in the CCES data between 1983 and 1984. MRCA data indicate that households' at-home consumption of fluid milk rose in 1985 and 1986, perhaps indicating a continuation of the rise in fluid milk and cream

consumption observed in the CCES data between 1983 and 1984. The MRCA and CCES data indicate that consumption of lowfat milk is steadily replacing fresh whole milk. About 69 percent of fluid milk is consumed at home, 16 percent away from home, and 15 percent as ingredients. But the at-home market seems to determine total consumption of fluid milk, implying that the long trend toward eating away from home has contributed to lower total fluid milk consumption.

- o Per capita consumption of ice cream and related products increased faster at home than elsewhere. The CCES and MRCA indicate that consumption of ice cream and related products increased during 1980-86. Disappearance data show consumption remained relatively constant over the period.

CHAPTER 4: DEMAND FOR U.S. DAIRY PRODUCTS

Dairy product prices rising slower than other food prices and rising consumer incomes were prime catalysts in 1983-86's large increase in per capita dairy product consumption. The retail price index for all dairy products rose less than the index for all foods since 1981. Dairy product prices rose on average only 1.2 percent annually since 1981, while prices of all foods rose 3.1 percent, meaning that relative prices of dairy products declined. Real disposable income per capita increased on average 3.3 percent per year during 1983-86, an increase over the 2-percent average annual increase in 1965-83. Advertising, concern about health and nutrition, changes in the profile of the population, and Government donations also affected consumption. But for most commodities, these influences were small compared with the effects of changes in relative prices and incomes. Decreasing (increasing) dairy product prices increases (lowers) per capita consumption of dairy products. But increasing income affects per capita consumption of individual dairy products differently.

This section examines the U.S. demand for dairy products. When possible, we empirically measure how consumers respond to changes in various factors. However, some factors that affect demand are not directly observable. In these cases, we present hypotheses that are more or less supported by the available, but limited, data.

PRICES AND INCOME ARE MAJOR DETERMINANTS IN DEMAND FOR DAIRY PRODUCTS

Our analysis indicates that changes in relative prices and income are the most important factors influencing annual changes in per capita consumption of dairy products. The effects of income and prices are first discussed separately, followed by an analysis of all prices and income.

Income

Quantitative analysis of the link between income and consumption has traditionally focused on measuring elasticities using real per capita disposable income. Real per capita income increased an average of 2.2 percent per year over the past 20 years but accelerated to more than 3 percent per year in the mid-1980's (fig. 12).

The responsiveness of dairy product consumption or expenditures to changes in real per capita disposable income can be measured using either time-series or household data (see box on factors affecting demand). Time-series estimates of income elasticities are generally referred to as short run, while elasticities from household data show a longer run response. It is difficult to isolate the separate effects of time trends and income on consumption in time-series demand models because of generally increasing income levels. As Brandow stated, "It is virtually impossible to separate statistically the effects of income and trend in the post-war period because real incomes per capita rose almost linearly and because prices and undeflated income were highly correlated" (3). Recognizing that the income elasticities may embody trend effects, time-series income elasticity estimates should be interpreted accordingly. Elasticity estimates from household data are free from this limitation, but they pertain only to at-home expenditures, which is not a limitation if a product is mostly consumed at home.

Prices, Income, and Other Factors Affect Demand for Dairy Products

We examined what happens to the quantities of dairy products consumed when prices and incomes change. Elasticity estimates were obtained from two econometric models that incorporated time-series data on prices of all foods, an index of nonfood prices, and income (12, 10). Elasticities show the percentage change in the quantity consumed for a given percentage change in price or income (see table 8). We assumed that changes in price or income had a negligible effect on per capita consumption when the elasticities were smaller than their standard errors. For example, changes in income had little or no effect on consumption of butter and frozen and other dairy products because the estimates were smaller than their standard errors.

A change in a product's own price affects consumption in the opposite direction (all price variables have negative coefficients), all other prices and income remaining unchanged. For example, the -0.31 price elasticity for all dairy products indicates that a 10-percent decrease (increase) in price increases (decreases) per capita consumption of total dairy products about 3 percent (table 8).

Changes in income affect consumption but produce varying consumer responses because the coefficients vary in sign and magnitude, depending on the product category and data source (table 8).

The neoclassical theory of consumer demand provides the major foundation for almost all empirical analyses of consumer demand behavior. Under this theory of individual (consumer) behavior, the individual's tastes and preferences are taken as given and unobservable. Faced with constraints such as given product prices and incomes over which the individual has little or no control, individual consumers are assumed to allocate their given income over all goods and services to achieve the greatest satisfaction. Economic theory, therefore, implies that the set of prices of all goods and services and the consumer's income are the primary factors determining the quantities of goods and services an individual consumes. It is common practice to use this theory of individual behavior to analyze market demand behavior, even though the available data and empirical methods cannot adequately accommodate all of the inherent theoretical specifications. For example, socioeconomic factors such as the distribution of total income among the population potentially influence demand. But limitations in empirical methods and available data often preclude considering all factors in a single model. Therefore, we used several models and analyses to evaluate how various factors affect consumption.

We used separate econometric models based on household survey data to obtain estimates of at-home dairy product elasticities. These provided additional evidence on the effects of income when factors other than just prices and income are considered.

We assessed how price and income changes affect consumption by using two estimated complete demand systems, based on USDA disappearance data, that incorporated the economic interdependence among foods under typical price and income constraints (12, 10). One system was used to measure and evaluate the price and income effects on aggregate U.S. demand for all dairy

products (12). The second system was used to obtain estimates for five individual dairy product categories: fluid milk, evaporated and dry milk, butter, cheese, and frozen and other dairy products (see 10 and app. 1).

The estimated demand systems were used to evaluate the effects of prices and income on the demand for dairy products in two ways. We examined the magnitude, significance, sign, and implications of the estimated parameters. We then evaluated the extent that the complete set of prices and income influenced the changes in per capita consumption over an extended period of time (see box on simulating demand).

Empirical demand studies often include socioeconomic and demographic factors that may influence demand behavior. These factors, except population growth, affect longrun rather than shortrun aggregate demand behavior because they change slowly over time. In addition to income-related factors, the most important socioeconomic and demographic variables include population growth, age, sex, race, family size and composition, and regional location. Econometric model results, from many studies using household data on at-home consumption and expenditures for dairy products, were used to evaluate the influence of these factors. Product convenience, food donations, commodity advertising and promotion, and concerns about health and nutrition, also affect demand. These influences were examined using other available studies and data.

Table 8--Price and income elasticities for dairy products

Products	: Price elasticity : : (time-series) 1/:	: Income elasticity : : (time-series) 1/:	: At-home income elasticity 2/ :(household survey)
	<u>Coefficient</u>		
Total dairy	-0.31	0.18	0.14
products	(.03)	(.05)	--
Fluid milk	-.26	-.22	.02
	(.12)	(.07)	--
Cheese	-.33	.59	.32
	(.12)	(.12)	--
Butter	-.17	.02	.35
	(.17)	(.19)	--
Evaporated,			
condensed, and	-.83	-.27	-.12 3/
dry milk	(.26)	(.22)	--
Frozen and			
other dairy	-.12	.01	.21
products	(.08)	(.06)	--

Note: The upper numbers are the elasticity estimates. The numbers in parentheses are the standard errors.

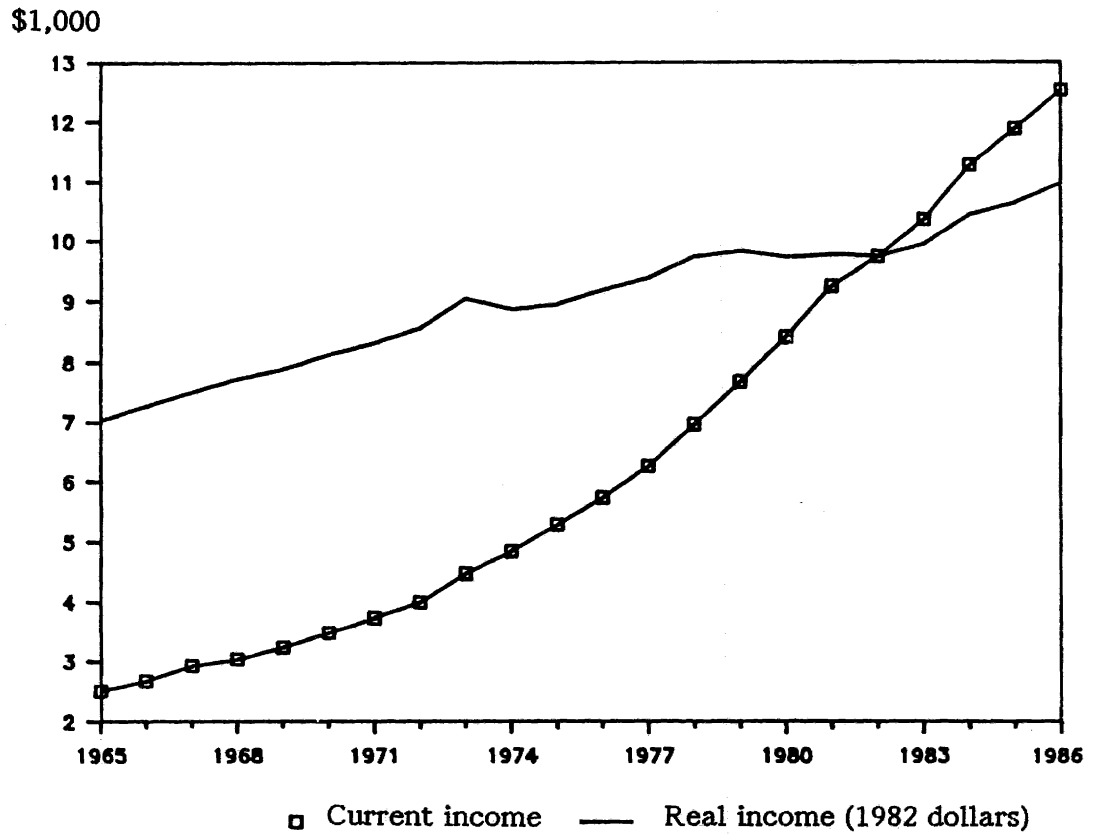
-- = Standard errors of elasticities not calculated; elasticities derived from statistically significant parameter estimates (except for fluid milk).

1/ Sources: Price and income elasticities for total dairy products from (12); price and income elasticities for all other dairy products from (10).

2/ Measures the responsiveness of product expenditures to income changes (app. table 1).

3/ Includes only canned milk.

Figure 12--Per capita disposable income



Income elasticities from time-series data show the percentage change in the quantity consumed for a given percentage change in income. (Table 8 in the box on factors affecting the demand for dairy products shows the estimated relationships between per capita consumption or expenditures and price and income changes for the major dairy products.) Estimates based on time-series disappearance data suggest that a 10-percent increase in income increases per capita consumption of total dairy products 1.8 percent and increases per capita cheese consumption 5.9 percent. But a 10-percent increase in income decreases per capita consumption of fluid milk and evaporated and condensed milk by 2.2 and 2.7 percent, respectively. Income hardly affects consumption of butter and frozen and other dairy products (both coefficients were small and not significant).

The large magnitude of the time-series income elasticities for fluid milk, evaporated, condensed, and dry milk, and cheese are probably influenced by time trends. Ward and Dixon obtained a 0.39 income elasticity for fluid milk, based on monthly data for 1978-86 (27). Even though their model includes a time trend, the elasticity appears high and may overstate the effect of income changes on fluid milk consumption.

The wide disparity in income elasticities from time-series data leads us to rely on estimates from household surveys (table 8, column 3). At-home fluid milk consumption, about 69 percent of total fluid milk use, has an expenditure elasticity of about zero according to most cross-section demand studies. This appears to be the most reasonable estimate of the income elasticity for fluid milk. As previously noted, at-home and away-from-home cheese consumption are about equal, each at approximately 38 percent of total use. Therefore, the income elasticity for cheese probably lies somewhere between the 0.3 estimate from household (at-home) data and the 0.6 time-series estimate.

We have seen that income elasticities from household survey data can provide insight into consumer response to income changes, even though the data reflect only at-home expenditures on dairy products. At-home per capita spending on fluid milk is not very responsive to income changes. However, some dairy items, such as cheese, show a marked response to income changes. For example, a 10-percent increase in income raises at-home per capita expenditures on cheese 3.2 percent. A further breakdown of individual product income elasticities suggests that a 10-percent increase in income lowers at-home expenditures on fresh whole milk about 1 percent (app. table 1). Most studies using household data agree with these findings, with respect to both the sign and magnitude of the elasticities (app. table 1).

A 10-percent increase in income increases at-home expenditures of total dairy products 1.4 percent (table 8). A 10-percent increase in income affects at-home per capita expenditures on individual dairy products differently, it:

- o Has little or no effect on per capita fluid milk expenditures,
- o Lowers per capita expenditures on canned milk 1.2 percent,
- o Raises per capita expenditures on frozen and other dairy products about 2 percent, and
- o Raises per capita expenditures on butter and cheese over 3 percent each.

Changes in relative prices are also major determinants of changes in per capita consumption for individual dairy products. Consumer Price Indexes (CPI's, which measure prices of goods and services) show the relative price change from the base year for a product category. The average increase in retail prices was lower for dairy products than for other foods since the mid-1970's (fig. 13). But prices of dairy products rose even slower relative to prices of all foods and all goods and services during 1981-86, meaning that relative dairy product prices declined. Although linked to support and farm-level prices, retail dairy product price indexes exhibit different patterns because of marketing costs, product transformations, and competitive conditions (15).

The economic theory of consumer demand assumes that if all prices and incomes increase by the same proportion, consumers will not alter their behavior by acting as if they had become wealthier. This assumption means that changes in relative prices, not changes in nominal prices, determine changes in consumption behavior. Recall that per capita dairy consumption increased during the same period that relative dairy product prices decreased (table 4, figs. 5, 13).

Per capita consumption of all dairy products moves in the opposite direction as relative dairy product prices. A 10-percent increase (decrease) in the own price of total dairy products decreases (increases) per capita consumption of total dairy products 3.1 percent. The responses to a 10-percent increase in individual dairy product prices are 2.6 percent for fluid milk, 8.3 percent for evaporated and dry milk, 1.7 percent for butter, 1.2 percent for frozen and other dairy products, and 3.3 percent for cheese (table 8). Consumption of total and individual dairy products also responds to changes in the prices of other dairy products and other foods.

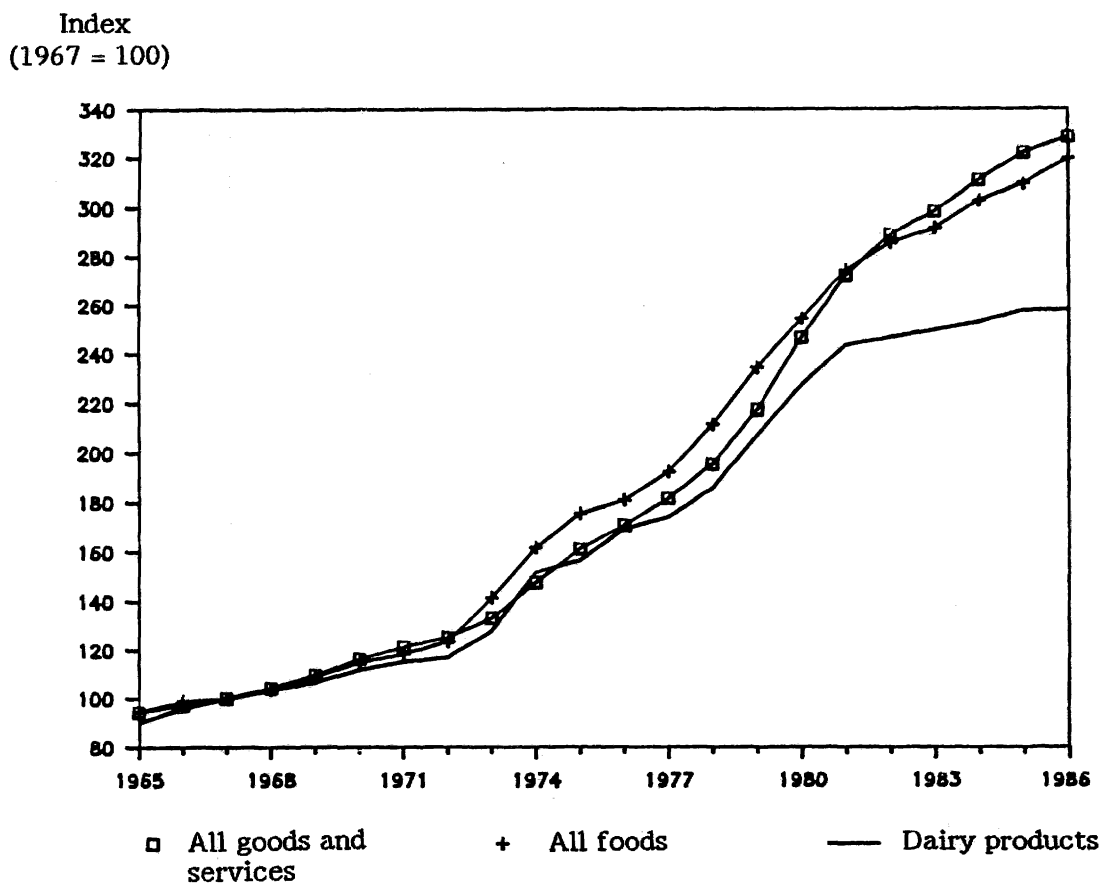
Total Dairy Products. A 10-percent increase in the price of total dairy products reduces per capita consumption by 3.1 percent, all else held constant (this variable had a negative coefficient, see table 8). Estimated relationships from a complete demand system showed that other foods are economically interdependent with dairy products (12). Fish, eggs, fresh fruit and vegetables, cereal and bakery products, and nonalcoholic beverages appear to be substitutes for dairy products. Consumers will tend to substitute dairy products for those foods when prices of dairy products fall and do the opposite when dairy product prices rise. Poultry, fats, processed fruit and vegetables, and sugar appear to be complements with dairy products. Decreases in the price of any complement increases consumption of all of them because changes in per capita consumption of complements move in the same direction.

Fluid Milk and Evaporated and Dry Milk. Fluid milk comprises whole milk and other milk beverages (mainly lowfat milk). Other factors held constant, a 10-percent increase in the price of fluid milk reduces per capita consumption 2.6 percent. Fluid milk's -0.26 price elasticity is quite similar to those found by Ward and Dixon (-0.25), Brandow (-0.29), and George and King (-0.35) (27, 3, 6). A 10-percent increase in the price of evaporated and dry milk reduces its per capita consumption 8.3 percent.

A cross-price elasticity between two commodities shows interdependence; it tells how much a change in the price of a particular food affects consumption

5/ Unless otherwise noted, prices refer to CPI price indices.

Figure 13--Consumer Price Indexes for dairy products, all foods, and all items



of another food. A 10-percent increase in the price of evaporated and dry milk increases the quantity of fluid milk demanded by 0.7 percent (table 9). However, with a cross-price elasticity of 0.71, per capita consumption of evaporated and dry milk increases 7.1 percent with a 10-percent increase in fluid milk prices. These results indicate that fluid milk and evaporated and dry milk are substitutes (both have positive coefficients). The cross-price elasticities between fluid milk, cheese, margarine, and those between evaporated and dry milk and frozen and other dairy products show rather strong substitution relationships. On the other hand, the cross-price elasticities between fluid milk and frozen and other dairy products, for example, indicate that these products are complements (both have negative coefficients).

Fluid milk also appears to have significant substitutes outside the dairy group, in such foods as carrots, celery, tomatoes, grapefruit, and chicken (10). Substitutes for evaporated and dry milk include foods such as chicken, eggs, apples, lettuce, carrots, and cabbage. Some complementary relationships outside the dairy group also exist. Evaporated and dry milk appear to be complements with grapefruit, bananas, other fruit, turkey, and pork. Fluid milk appears to be a complement with pork, turkey, fish, eggs, potatoes, bananas, and carrots.

Table 9--Price elasticities for dairy products and margarine

Quantities	Price elasticity for--						
	Fluid	Evaporated and dry	Frozen dairy	Cheese	Butter	Margarine	Income
	milk	milk	products				elasticity
							1/
	Coefficient						
Fluid milk	-0.259	0.074	-0.090	0.103	0.002	0.017	-0.221
	(.120)	(.041)	(.028)	(.024)	(.021)	(.011)	(0.069)
Evaporated and dry milk	.713	-.826	.274	-.140	.089	-.051	-.266
	(.395)	(.264)	(.138)	(.101)	(.113)	(.083)	(.223)
Frozen and other dairy products	-.253	.079	-.121	.021	-.045	.028	.011
	(.079)	(.040)	(.085)	(.037)	(.043)	(.019)	(.058)
Cheese	.453	-.068	.031	-.332	-.241	.040	.593
	(.109)	(.048)	(.061)	(.117)	(.058)	(.021)	(.120)
Butter	.032	.080	-.144	-.460	-.167	.048	.023
	(.179)	(.103)	(.137)	(.110)	(.175)	(.067)	(.192)
Margarine	.201	-.066	.125	.110	.067	-.267	.111
	(.139)	(.105)	(.082)	(.057)	(.093)	(.137)	(.107)

Note: The upper numbers are elasticity estimates. The numbers in parentheses are the standard errors.

1/ See discussion of income elasticities estimated using time-series data.

Source: (10).

Butter. Changing butter's price hardly affects the consumption of butter. Although butter has a price elasticity of -0.17 , we are not confident that the elasticity is different from zero because of its relatively large standard error (0.17). Margarine responds more to changes in its own price than does butter, with a -0.27 elasticity. George and King (6) found butter to be more responsive to price changes than did Huang (10), partly because George and King's data covered 1955-65, which is before the large subsequent shift toward more away-from-home eating.

The estimated cross-price elasticities between butter and margarine are 0.05 and 0.07 , respectively (table 9). Although these estimates indicate that the two products may be substitutes, the elasticities are not significant because their magnitudes are smaller than their standard errors.

Significant negative cross-price elasticities between butter and cheese of -0.46 and -0.24 , respectively, indicate a complementary relationship in consumption but for unknown reasons. Although it is a complement with fish and certain fruit and vegetables, and a substitute for other vegetables, other fruit, and chicken, butter has few strong relationships with foods outside the dairy group.

Frozen and Other Dairy Products. An own price change hardly affects per capita consumption of frozen and other dairy products. A 10-percent increase (decrease) in its price, decreases (increases) its consumption 1.2 percent (table 9). Frozen and other dairy products are apparently complements with fluid milk, coffee, beef, and pork. Apparent substitutes include evaporated and dry milk, margarine, chicken, fish, eggs, bananas, grapefruit, celery, and cabbage.

Cheese. Cheese is perhaps the most complicated dairy product because of the many varieties that may be classified according to degree of hardness, structure, or the type of organisms responsible for ripening the product.

Cheese is often broadly classified into American cheese (including Cheddar, colby, washed curd, stirred curd, and Monterey Jack) and other cheese (including a wide variety of Italian cheeses, Swiss cheese, Brick, Muenster, and miscellaneous cheeses).

The estimated price elasticity for cheese is -0.33 (table 9), which is similar to George and King's -0.46 elasticity estimate (6). Cheese appears to be a strong substitute for fluid milk and a strong complement with butter. Cheese shows some significant relationships with nondairy foods (10). The cross-price elasticity of cheese with beef and veal prices is -0.26 , a complementary relationship that may partially reflect popular complementary preparations, such as cheeseburgers. Cheese also seems to be a complement with other fats, grapes, grapefruit, tomatoes, and onions. Apparent cheese substitutes include margarine, apples, celery, cabbage, canned tomatoes, and sugar.

How Prices and Income Combined To Affect the Demand for Dairy Products

The elasticity estimates, combined with observed changes in prices and income, suggest that relative prices and income were the dominant factors determining changes in per capita consumption of dairy products. We compared actual changes in consumption with the simulated changes to assess the performance of the estimated demand relationships (see box on simulations). The simulations of per capita consumption of dairy products, based on an estimated complete

Simulating Price and Income Effects on Demand

Applying a complete set of estimated elasticities to the actual changes in price and income confirmed that prices and income are the dominant factors determining per capita consumption (12, 10, 11). The simulations demonstrate that the estimated demand systems reasonably represent the demand structure for dairy products.

Estimated demand elasticities demonstrated the extent that consumption of dairy products responds to changes in income and dairy product prices. However, by themselves, these elasticities tell only part of the story: they show the marginal effects of the individual own-prices and income, when all other prices or income remain unchanged. But economic theory specifies that all prices and income potentially affect the quantity demanded of any good. The complete demand systems from which these elasticities were obtained incorporated and supported this theoretical economic interdependence between consumption, all prices, and income. Therefore, to more fully assess the influence of relative prices and income on consumption of dairy products, we must evaluate how closely the estimated demand systems describe the actual observed consumption of dairy products. For evaluation, we used the two estimated complete demand systems to simulate consumption of dairy products over an extensive historic period (see box on factors affecting the demand for dairy products and app. 1). We then compared the simulated consumption of dairy products with the corresponding actual consumption.

The complete demand system containing 40 food commodities and 1 nonfood category was used to obtain elasticities for the five individual dairy product categories (10). Using this estimated demand system as an example, the simulation and its evaluation are briefly described.

Since the demand system is estimated in terms of relative changes, for each year we inserted the actual change in each of the 41 price indexes and income. The estimated elasticities were used to compute the effect of each price and income change and, for each dairy product category, these effects were summed to obtain a simulated change in consumption for the dairy product for a given year. The procedure was repeated for each year, yielding a series of simulated changes in consumption for each product category. Since actual consumption is represented by a per capita consumption index (1967=100), the simulated changes were transformed to index levels by using the actual index level in the preceding year as a base. The actual and simulated values of the per capita index for each of the five dairy product categories are shown in figure 14.

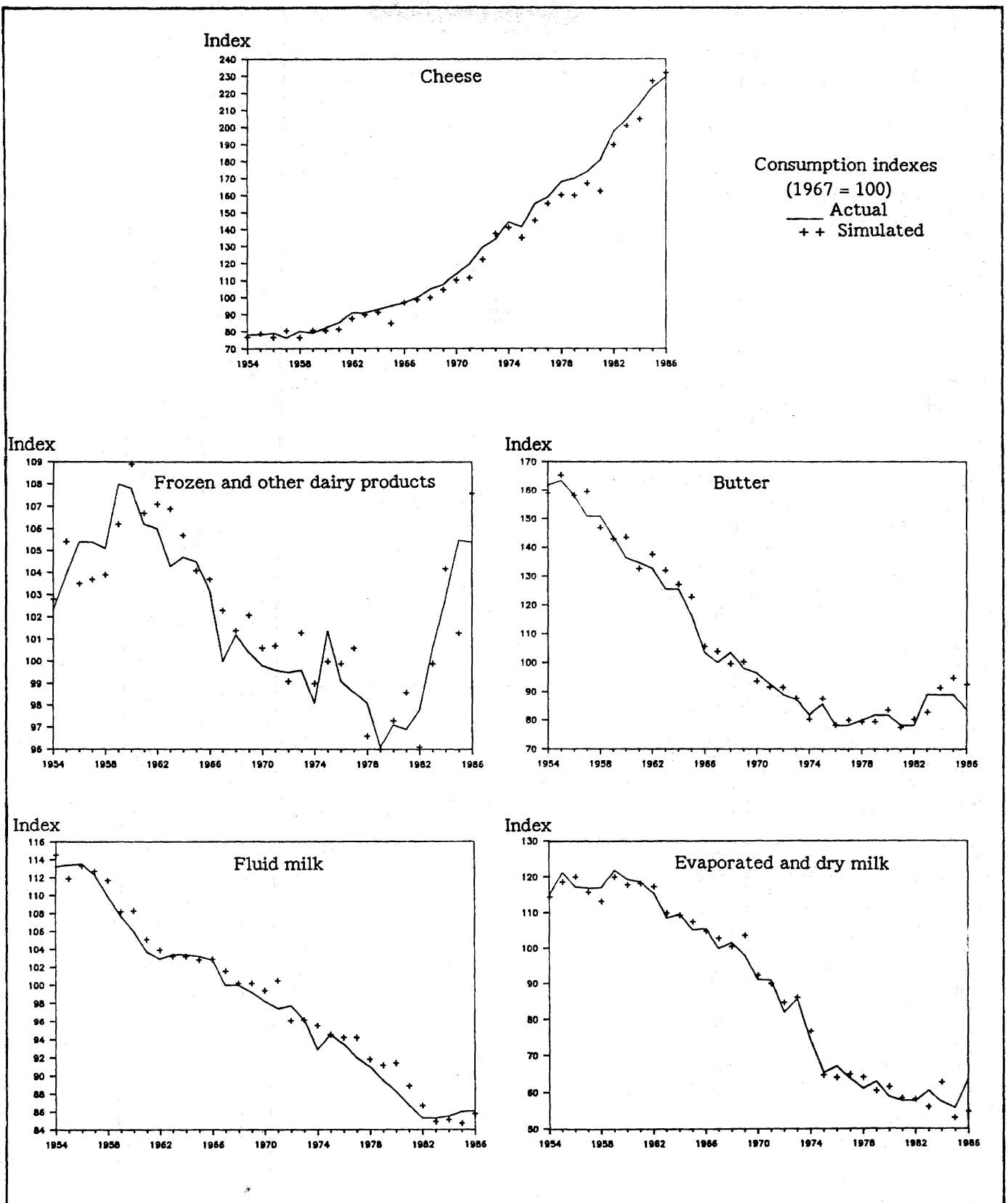
The difference between each actual and simulated value--the error--reflects the portion of the change in per capita consumption that is not explained by the combination of changes in price and income and the estimated set of parameters that is assumed to represent the empirical demand structure over the period. The error may reflect some demand factors not incorporated into the empirical model. For example, factors such as health-related issues, advertising expenditures, and demographics might be responsible for some of the changes in consumption that cannot be attributed to price and income changes. To obtain a measure of the average error over the simulation period for each dairy product category, we calculated the ratio of the root-mean-square error to the mean of the simulated variables as follows:

$$RMS/\bar{y} = [(1/T) \sum_{t=1}^T (y_t - y_t^*)^2]^{1/2} / \bar{y} \times 100,$$

where y_t , y_t^* , and \bar{y} are, respectively, the actual, simulated, and sample mean of per capita consumption.

The computed error measure over the 1954-86 period for the the five dairy product categories, in percentage terms are: fluid milk, 1.47; evaporated, condensed, and dry milk, 3.23; butter, 3.63; frozen and other dairy products, 1.52; and cheese, 4.51. The error measure for all dairy products, computed by Huang and Haidacher using a composite demand system for 1950-81, was 0.71 (12).

Figure 14—Simulated annual per capita consumption of dairy products



food demand system incorporating the complete set of prices and income, showed simulated values conformed closely to the per capita quantities actually observed (fig. 14). Statistical measures indicate that the difference between actual and simulated per capita consumption levels was less than 5 percent for all dairy product categories (see box on simulations).

We have seen that consumption of dairy products responds to changes in income and dairy product prices and to changes in the relative prices of other foods. Our assessment of the combined effects of all prices and income, including cross-commodity relationships, is that most of the observed changes in per capita consumption are attributable to relative price and income changes.

SOCIOECONOMIC AND DEMOGRAPHIC FACTORS AFFECT CONSUMPTION

Socioeconomic and demographic factors such as regional, racial, and age distributions of the population; participation in the Food Stamp Program; and seasonal purchase patterns influence dairy consumption. But even when combined, these factors have only a limited effect on yearly changes in per capita consumption (2, 20, 16, 4). Demographic variables are probably more important in explaining variations in expenditures between households or groups of households than in explaining yearly fluctuations in national per person spending because factors such as regional, racial, and age distributions change slowly over time (2, 7, 4). Even in the long run, changes in U.S. age distribution, regional population distribution, and racial composition would combine to increase per capita cheese consumption by less than 1.4 percent from 1980 to 2000 (table 10). While population growth helps

Table 10--Projected changes in expenditures for food consumed at home from shifts in demographics

Shifts	Changes in expenditures from 1980 levels				
	Milk and cream	Other dairy products 1/	Cheese	Butter	Total dairy products
	Percent				
Age distribution:					
1990	-0.2	0.5	1.0	1.1	0.5
2000	-.9	2.1	1.9	1.8	1.6
Regional distribution:					
1990	-.1	.1	-.2	-.7	-.1
2000	-.2	.3	-.4	-1.3	-.1
Racial distribution:					
1990	-.3	-.2	-.5	-.2	-.3
2000	-.5	-.4	-.1	-.3	-.6
Total change: 2/					
1990	-.6	.4	.3	.2	.1
2000	-1.6	2.0	1.4	.2	.9

1/ Includes evaporated, condensed, and dry milk and others.

2/ Net adjustment after accounting for projected changes in all variables.

Source: (2).

increase national dairy consumption, it cannot be relied upon to expand dairy consumption at historic rates because the population growth rate has slowed to less than 1 percent per year.

When combined with projected population growth, changes in demographic factors increase aggregate at-home demand for total dairy products by about 1 percent per year (2). Cheese consumption at home is projected to increase about 11 percent during 1980-90, and milk and cream to increase about 10 percent. At-home consumption of total dairy products is projected to increase about 10.5 percent between 1980 and 1990 due to the combined effects of demographic changes and population growth.

We used cross-sectional data from national household surveys to measure how socioeconomic and demographic factors affect consumer demand for dairy products (see boxes in Chapter 2 on data). These data also allow us to analyze the at-home market demand for dairy products. This section relies primarily on 1977/78 NFCS data because they contain a broader array of dairy products (1).

While studies may differ in the magnitude of the effects of household characteristics on demand, they agree on the direction of the effect (therefore, little generality is lost by focusing on a particular study). For example, based on NFCS and CCES data, the Blaylock and Smallwood studies found that residents of the Northeast and West had the largest per capita expenditures for dairy products (1, 2). Both of these studies, and studies by Salathe and Buse; and Salathe, Gallo, and Boehm; and others, found that blacks spend considerably less on dairy products than do whites, and that older people spend more on cheese and butter than do younger people (21, 22, 23).

Regional Distribution of the Population

Expenditures on dairy items varied across regions, using the Northeast as a base (table 11). Per capita expenditures on total dairy and related products are highest in the Northeast and lowest in the South (table 11). While this expenditure pattern was also true for cheese, it did not hold for all products. For example, other fresh milk expenditures were higher in the North Central, South, and West than in the Northeast. Natural American and Cheddar cheese expenditures were lowest in the Northeast, but northeasterners spent more for processed and other cheeses. Northeastern residents also spent more for butter and less on margarine than did residents of other regions. There appears to be slightly more similarity in dairy expenditures in the North Central, South, and West than across the Nation. Differences in relative prices or dairy product standards may have caused some of the apparent differences in regional expenditures. For example, the South had higher cottage cheese prices, which may account for some of their lower expenditures on cottage cheese.

Urbanization

Expenditures on total dairy products were similar across levels of urbanization, but expenditures on individual products varied substantially (table 12). Consumption for suburban residents was closer to those in central cities than in nonmetro areas. The only significant differences in dairy expenditures between central city and suburban residents were for other milk, cream substitutes, frozen desserts, and natural American and Cheddar cheeses

(table 12). Expenditures for nonmetro residents, however, differed from central city residents in 12 of the 20 dairy products, especially for canned milk, other cheeses, sour cream and dips, and butter.

Table 11--Simulated weekly per capita expenditures, by region 1/

Dairy products	Expenditures by region			
	North	Central	South	West
	<u>Percentage difference 2/</u>			
Total dairy and related products <u>3/</u>	-11.2	-14.0	-4.5	
Dairy products <u>4/</u>	-13.1	-15.4	-5.1	
Fresh milk	-5.7	.6	-.4	
Whole	-37.6	-6.1	-32.9	
Other	128.7	40.1	117.0	
Processed milk	-11.0	16.9	34.5	
Canned	9.3	121.5	91.8	
Dry	-20.6	-33.4	16.0	
Cream	20.5	-48.8	14.2	
Cream substitutes	14.8	24.4	-17.0	
Frozen desserts	-11.8	-16.4	-15.7	
Cheese	-15.1	-24.3	-1.5	
Natural American and Cheddar	26.0	-24.4	98.4	
Processed	-8.8	-10.7	-34.5	
Other	-45.5	-73.0	-34.1	
Cottage cheese	-4.9	-52.5	6.7	
Sour cream and dips	-3.0	-43.8	7.4	
Table spreads	-10.9	-22.7	-16.6	
Butter	-49.6	-69.8	-50.9	
Margarine	22.5	16.5	13.6	

1/ Factors other than region are held constant at their sample means.

2/ Percentage change from expenditures in the base region (Northeast).

3/ Includes margarine and cream substitutes.

4/ Excludes margarine and cream substitutes.

Source: (1).

Race

Blacks and other racial groups (nonwhite, nonblack) had lower weekly per capita expenditures than did whites for virtually all dairy items (table 13). Blacks spent almost 25 percent less per person than did whites for total dairy products, 25 percent less for cheese, and 20 percent less for margarine.

Table 12--Simulated weekly per capita expenditures, by urbanization 1/

Dairy products	Expenditures by urbanization	
	Suburban	Nonmetro
	Percentage difference <u>2/</u>	
Total dairy and related products <u>3/</u>	2.1	-2.2
Dairy products <u>4/</u>	2.2	-3.3
Fresh milk	1.0	3.2
Whole	-2.8	1.5
Other	17.8	11.1
Processed milk	-7.2	17.4
Canned	-13.3	29.4
Dry	-2.2	16.4
Cream	10.7	8.1
Cream substitutes	17.6	14.6
Frozen desserts	12.0	5.4
Cheese	3.5	-12.5
Natural American and Cheddar	8.9	10.1
Processed	1.3	-12.2
Other	5.2	-36.0
Cottage cheese	1.7	-5.1
Sour cream and dips	-10.7	-25.8
Table spreads	.3	-2.1
Butter	.2	-34.1
Margarine	-.3	13.6

1/ Factors other than urbanization are held constant at their sample means.

2/ Percentage change from expenditures in the base urbanization group (the central city).

3/ Includes margarine and cream substitutes.

4/ Excludes margarine and cream substitutes.

Source: (1).

However, blacks spent approximately 86 percent more for canned milk. These findings are consistent with those reported by Thraen, Hammond, and Buxton (26).

Age

Per capita dairy expenditures varied significantly across households with different aged members. Households with children aged 2 and under spent more on total dairy products than did households without young children, mostly

Table 13--Simulated weekly per capita expenditures, by race 1/

Dairy products	Expenditures by race	
	Black	Other (nonwhite, nonblack)
	Percentage difference <u>2/</u>	
Total dairy and related products <u>3/</u>	-24.8	-6.8
Dairy products <u>4/</u>	-24.8	-6.4
Fresh milk	-28.7	.7
Whole	-12.4	39.1
Other	-48.5	-79.7
Processed milk	8.4	-39.1
Canned	86.5	3.7
Dry	-56.0	-72.0
Cream	-35.4	-57.9
Cream substitutes	-64.3	-57.9
Frozen desserts	-12.7	-22.3
Cheese	-25.0	-9.0
Natural American and Cheddar	-11.2	-20.5
Processed	-27.1	-6.6
Other	-63.0	-20.9
Cottage cheese	-67.8	-20.1
Sour cream and dips	-78.8	-45.5
Table spreads	-11.5	-11.1
Butter	12.1	-16.3
Margarine	-20.2	-10.2

1/ Factors other than race are held constant at their sample means.

2/ Percentage change from expenditures in the base group (whites).

3/ Includes margarine and cream substitutes.

4/ Excludes margarine and cream substitutes.

Source: (1).

because of higher expenditures for fresh and processed milk (which includes infant formula) (table 14). However, households with teenagers spent considerably more per person on total dairy products than did households with infants. Households with teenagers spent considerably more for fresh milk, frozen desserts, processed cheese, and sour cream and dips. Households

Table 14--Simulated weekly per capita dairy expenditures, by age group 1/

Dairy products	Expenditures by age (years)				
	0-2	3-12	13-19	20-39	65 and older
	<u>Percentage difference 2/</u>				
Total dairy and related products <u>3/</u>	15.2	-5.8	17.1	-2.6	0.1
Dairy products <u>4/</u>	19.2	-3.6	20.6	.4	-1.8
Fresh milk	35.7	20.5	46.5	-3.7	.3
Whole	20.5	22.8	45.6	-4.9	-5.2
Other	39.8	-21.6	10.4	-5.5	18.7
Processed milk	614.4	-31.8	11.5	-20.7	19.6
Canned	1,522.2	-49.0	-6.3	-43.9	37.2
Dry	45.2	-8.7	35.4	-2.1	11.3
Cream	-37.1	-19.1	-22.2	-38.7	62.3
Cream substitutes	-30.7	-20.6	-25.7	-57.2	56.6
Frozen desserts	-36.4	16.7	23.1	-19.5	14.6
Cheese	-28.9	- 8.5	11.2	22.9	-14.1
Natural American and Cheddar	-19.8	-18.5	19.7	6.3	-7.7
Processed	16.4	30.1	23.5	8.1	-26.5
Other	-45.4	-2.6	30.1	65.0	2.6
Cottage cheese	-76.2	-30.2	-19.7	-21.8	2.2
Sour cream and dips	-33.5	39.7	80.4	35.4	-7.5
Table spreads	-39.8	-34.4	-21.3	-13.3	10.5
Butter	-54.8	-44.7	-19.2	22.2	-2.5
Margarine	-24.6	-23.9	-19.0	-31.1	17.5

1/ Factors other than age composition are held constant at their sample means.

2/ Percentage change from expenditures in the base age group (40-60 years old).

3/ Includes margarine and cream substitutes.

4/ Excludes margarine and cream substitutes.

Source: (1).

composed of elderly persons had the highest per capita expenditures on other milk, processed milk, cream, and margarine (table 14). The elderly, however, spent less on cheese, especially processed cheese.

Participation in the Food Stamp Program

Per capita expenditures on total dairy products were highest for households receiving food stamps (table 15). Households receiving food stamps, however, generally used less-expensive dairy products than did other households.

Table 15--Simulated weekly per capita dairy expenditures, by households participating in the Food Stamp Program 1/

Dairy products	:	Expenditures by food stamp recipients
	:	<u>Percentage difference 2/</u>
Total dairy and related products <u>3/</u> :	:	12.9
Dairy products <u>4/</u> :	:	13.0
Fresh milk	:	20.8
Whole	:	25.3
Other	:	-3.5
Processed milk	:	5.1
Canned	:	9.8
Dry	:	7.7
Cream	:	-12.9
Cream substitutes	:	-30.4
Frozen desserts	:	-2.7
Cheese	:	10.2
Natural American and Cheddar	:	-.3
Processed	:	17.5
Other	:	-24.2
Cottage cheese	:	-16.6
Sour cream and dips	:	-24.3
Table spreads	:	4.6
Butter	:	-22.0
Margarine	:	13.2

1/ Factors other than food stamp status are held constant at their sample means.

2/ Percentage change from expenditures in the base group (households not participating in the Food Stamp Program).

3/ Includes margarine and cream substitutes.

4/ Excludes margarine and cream substitutes.

Source: (1).

Seasonal Variation

Weekly per capita dairy expenditures varied widely by season, but differences may be caused by relative price variations, climate, and the timing of holidays (table 16). Expenditures were higher in the summer, fall, and winter than in the spring for total dairy and for many individual dairy products. For example, processed milk expenditures are highest in the fall and winter, probably because of holiday food preparation and baking. Per capita expenditures for frozen desserts were lowest in the fall and winter.

Table 16--Simulated weekly per capita expenditures, by season 1/

Dairy products	Expenditures by season		
	Summer	Fall	Winter
	<u>Percentage difference <u>2/</u></u>		
Total dairy and related products <u>3/</u>	7.2	7.3	-6.5
Dairy products <u>4/</u>	6.7	6.6	5.8
Fresh milk	5.3	8.2	9.6
Whole	7.5	13.9	14.2
Other	.3	-3.0	-.8
Processed milk	8.3	17.7	13.9
Canned	6.2	19.4	1.3
Dry	20.5	19.2	35.2
Cream	7.4	17.5	-2.0
Cream substitutes	26.7	-8.4	2.0
Frozen desserts	9.6	-11.4	-17.4
Cheese	5.4	8.8	8.4
Natural American and Cheddar	3.1	8.5	8.5
Processed	8.6	9.4	19.3
Other	4.9	5.1	-1.3
Cottage cheese	3.2	-9.8	-7.1
Sour cream and dips	1.9	4.6	9.4
Table spreads	12.9	19.8	17.1
Butter	3.6	15.4	12.1
Margarine	14.7	18.5	16.6

1/ Factors other than season are held constant at their sample means.

2/ Percentage change from expenditures in the base season (spring).

3/ Includes margarine and cream substitutes.

4/ Excludes margarine and cream substitutes.

Source: (1).

OTHER FACTORS AFFECT THE DEMAND FOR DAIRY PRODUCTS

Factors other than income, prices, and demographics influence consumption of dairy products. Advertising, concerns about health and nutrition, convenience, food assistance programs, and world dairy trade combine to affect demand, but these influences are small relative to effects from prices and income.

Advertising

Generic and brand advertising may have bolstered per capita consumption of some dairy products, especially fluid milk. Preliminary results suggest, however, that advertising has relatively little effect on demand when compared with price and income effects. This section attempts to put the issue into perspective.^{6/}

We base our findings of how advertising affects dairy demand on empirical analyses conducted by Ward and Dixon on how generic advertising influences the demand for fluid milk and a study by USDA's Economic Research Service on how advertising affects the demand for cheese (27). The July 1, 1987, USDA report to Congress on the dairy promotion program reflects both these studies (27). The effects of advertising on the demand for fluid milk and cheese were analyzed with econometric models. We relied on information and research supplied by the National Dairy Board for advertising's effects on butter, ice cream, and dairy calcium because few studies quantify these effects with econometric modeling (17). This section examines the effectiveness of advertising from the standpoint of increasing consumption.

Fluid Milk. Milk advertising did not cause the observed 1-percent increase in total fluid milk consumption between 1985 and 1986. Total consumption increased because the U.S. population grew 1 percent; that is, per capita consumption was unchanged. Total fluid milk consumption increased by 1.6 percent between 1984 and 1985, which can be disaggregated into 1 percentage point caused by population growth and 0.6 percentage point caused by all other factors (prices, incomes, advertising, and others) combined.

The 1987 report to Congress on the dairy promotion program alleged that advertising accounted for about 10.5 percent of fluid milk consumption between September 1984 and September 1986: that is, sales would have been 10.5 percent less during September 1984–August 1986 if products were not advertised (27). But, given the above analysis, this means that advertising only slowed the decline in fluid milk consumption that would have been observed if products were not advertised, except for perhaps a small positive influence in 1984–85. These conclusions are essentially the same as those presented in "Review of NDB Promotion Programs" prepared by the National Dairy Board Evaluation Staff and submitted to the USDA Evaluation Committee in April 1987 (17).

Cheese. Cheese consumed away from home and as ingredients in processed foods increased. The disappearance data show increased cheese consumption

^{6/} A detailed analysis of advertising effectiveness was requested as a separate study by the National Commission on Dairy Policy. The study was conducted by university researchers.

Background on Advertising

Advertising is directed toward increasing sales to both existing and potential consumers of a product. Some campaigns promote specific name-brands while other campaign strategies are designated to promote the generic commodity categories, such as cheese.

According to Sheth, advertising produces potential changes in consumer demand through four mechanisms: precipitation, persuasion, reinforcement, and reminder (24). Precipitation encourages consumers to become buyers of a product, persuasion encourages consumers to choose among alternative brands in a product category, reinforcement continually directs the consumer's attention to a particular brand or product in order to achieve repeated purchases of the product, and reminder encourages consumers to become repeat purchasers of the product (24). Generic advertising precipitates and reminds, while brand advertising persuades and reinforces (36). Precipitations and reminders are more likely to increase industry sales, while persuasions and reinforcements generally maintain or increase market shares.

There is some evidence that generic advertising increases aggregate demand, or at least reduces the rate of decline in consumption, for a few commodities (38, 36, 14). The empirical evidence that brand advertising increases aggregate demand is less persuasive. Depending on the commodity and the nature of the promotion activities, generic and brand advertising campaigns can complement or compete with each other.

Generic advertising theoretically is brand-neutral, but not if generic promotion emphasizes the common characteristics of a product group while a brand advertising campaign stresses differences. Also, generic advertising may not be brand-neutral if one firm has a large share of the market for the commodity being advertised, such as for cheese. If one firm dominates the brand advertising for a particular product (such as with processed cheese), brand advertising may serve as a form of brand and generic promotion.

The Dairy and Tobacco Adjustment Act (P.L. 98-180) established the National Dairy Promotion and Research Board in 1983, which developed a coordinated program of promotion activities to increase consumer demand for dairy products. The board pursues its national programs of promotion, research, and nutrition education from a mandatory assessment of 15 cents per cwt on all milk produced for commercial use (the board began its advertising activities in late 1984). Up to 10 cents per cwt of the assessment can be paid to qualified State and regional promotion programs. The State and regional programs conduct their own advertising and promotion programs that supplement the board's efforts. USDA must report to Congress each year on the dairy promotion program, including an evaluation of the effectiveness of generic advertising for dairy products.

and the MRCA data show decreased at-home consumption, which then increased in 1986. The increase in at-home cheese consumption between 1985 and 1986 can be attributed to rising consumption of processed cheeses. It is doubtful that generic cheese advertising produced the increases, as the upward trend in the USDA disappearance figures began long before the formation of the National Dairy Board and before extensive cheese advertising by qualified regional promotion programs. This upward trend appears to be slowing, especially for American-type cheeses.

The cheese model indicates that generic advertising bolstered cheese consumption by slowing the rate of decline in at-home consumption. At-home cheese consumption would have been 3.5 percent less than observed over September 1984-June 1986 if generic advertising had not increased under the 1983 Tobacco and Dairy Adjustment Act. The model used to produce these findings used MRCA data (only covering at-home consumption) for January 1982 through June 1986. The model cannot determine the effects of advertising on consumption of cheese away from home or as ingredients in processed foods.

The "Review of NDB Promotion Programs" concurs with our assessment (17). The report notes that tracking studies show no significant changes in attitudes toward cheese since the cheese advertising campaign began in the fall of 1984. Cheese advertising messages performed at or below average in day-after recall tests. The report concludes by noting that the promotional effort had little or no short-term effect on at-home consumption of cheese (17).

Butter. It is too soon to judge advertising's effectiveness in increasing butter sales. The current ad campaign with the slogan "Give 'em all a little pat of butter" performed well in tracking studies, which show positive shifts in public awareness of the advertising and in attitudes toward butter. Total commercial disappearance of butter increased each year in 1983-86. However, per capita consumption increased in 1983-85, with per capita consumption holding steady between 1985 and 1986. Increased butter consumption appears to be in the away-from-home and ingredients markets.

Ice Cream. Per capita consumption of ice cream held steady at about 18 pounds per person between 1984 and 1985, but increased to 18.3 pounds in 1986. As noted earlier, at-home consumption of ice cream increased during 1980-84. MRCA data indicate that at-home consumption of ice cream increased slightly between 1985 and 1986. However, we cannot link the increased at-home consumption of ice cream with generic advertising because no econometric analysis of the National Dairy Board's ice cream advertising campaign is available. But the summer 1986 advertising campaign received high marks in tracking studies for "attention-getting" and "convincing." These studies also indicated that attitudes towards ice cream are very positive (17).

Calcium Advertising. The dairy calcium advertising campaign that began in late 1984 centered on combating osteoporosis (a degenerative bone disease) by consuming dairy products. The campaign originally targeted women 13 to 70 years old, and later focused on women 25 years old and over.

The calcium campaign generally received positive results in tracking studies (17). Advertising was rated informative and meaningful, producing favorable public awareness. But no definitive evidence exists that the calcium advertising campaign has or has not increased the consumption of dairy products. However, the generic advertising variables in the fluid milk and

cheese models include 75 and 25 percent, respectively, of the funds spent on the calcium campaign. Therefore, the positive relationship between generic advertising and sales found in these models also applies to the calcium advertising expenditures.

Concerns About Health and Nutrition

There is little, and ambiguous, evidence on how attitudes about health and nutrition affect purchases of dairy products. For example, one study showed that the dietary intake of calcium increased, but the share coming from dairy products decreased (27). Also, the consumption of lowfat milk is steadily replacing whole milk, yet cheese consumption is rising despite awareness about fat and cholesterol.

American consumers are becoming increasingly aware of the relationship between food and general health. Consumers are concerned about controlling weight by consuming fewer calories, preventing nutrition-related diseases by taking vitamins and minerals such as calcium, reducing the likelihood of heart disease by decreasing consumption of cholesterol and saturated fats, and increasing the amount of dietary fiber. Market surveys show that foods' nutritional value is increasingly cited as a factor in determining consumers' food selection and purchase behavior (13).

The dairy industry has spent millions of dollars in nutrition-related research on dairy products and promoting health-related aspects of dairy products. For example, the industry emphasizes dairy products as a natural source of dietary calcium, a mineral that many women consume in insufficient quantities. The industry also promoted fluid milk as "fitness you can drink." Milk is a nutritious alternative to other beverages, such as sodas.

In addition to the changing demographics of the population over the past 30 years, concern for reducing fat intake has been cited as a major factor influencing the trend away from whole milk to lowfat and skim milk (13).

Reducing cholesterol intake has been associated with increased margarine consumption over butter. While many nutritionists argue that dairy products, particularly cheese, are a source of dietary cholesterol, cheese consumption has more than doubled in the last two decades.

Although there has been considerable discussion of how concerns over nutrition and health affect demand for dairy products, few empirical studies quantitatively link them. A recent study funded by the National Dairy Promotion and Research Board attempted to examine the link between consumption and awareness of dairy products as natural sources of calcium (27). The study examined consumption in a national sample of women 19-52 years old surveyed in 1985/86, with a similar sample surveyed in 1977/78. The analysis revealed that dairy products contributed about 42 percent of their daily calcium intake, but the women tended to consume less than the recommended daily allowance. While the dietary intake of calcium increased, the share coming from dairy products decreased (27). Whole milk consumption fell, while lowfat and skim milk, yogurt, frozen desserts, and cheese increased.

Convenience

Developments in packaging and processing, such as individually wrapped cheese slices and frozen/prepared dairy products, benefited consumers by making some

products more convenient to use. Processing innovations, such as ultra processing and aseptic packaging, increase shelf-life of the product and reduce the need for refrigeration. The growing demand for convenience together with growth in the fast-food industry, particularly pizza outlets, benefited cheese consumption (19, 18).

Many consumers desire convenient products. Although not easily defined, convenience transfers the time or activity needed to prepare foods from the household to the processing or marketing sector. Sales of convenience foods continue to rise as the value of consumers' time rises due to higher real wages and more women in the workforce. New products, ingredients, and services make many foods more accessible to consumers.

The desire for convenience foods may influence the development of new products. However, for the consumer, convenience may simply be measured in terms of the time or effort required to prepare the foods. In this context, natural cheese and fluid milk require little or no household preparation.

Domestic Food Assistance Programs

The Government donates cheese, butter, and dry milk from surplus supplies that accumulate through legislated dairy price-support programs. Government distributions of surplus dairy products through domestic food assistance programs increased dramatically between 1977 and 1984 with only slight declines in 1985 and 1986 (table 17). The Government distributes dairy products through the National School Lunch Program and other child nutrition

Table 17—Dairy products distributed through USDA commodity programs

Dairy products :	Dairy distributions									
	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
	:	:	:	:	:	:	:	:	:	:
	:	:	:	:	:	:	:	:	:	:
	1,000 pounds									
Butter	64,384	61,692	85,692	91,990	99,882	104,015	259,358	247,207	232,889	184,638
Processed cheese	77,897	68,083	84,308	83,234	88,968	206,715	470,828	481,157	515,071	528,836
Cheddar cheese	--	--	--	--	37,627	45,777	99,421	168,794	75,905	39,670
Mozzarella cheese	--	--	--	39,103	22,767	10,778	35,202	34,615	30,384	27,211
Nonfat dry milk	26,646	35,653	44,055	38,513	42,410	45,558	74,760	118,433	123,164	137,727
Evaporated milk	10,753	15,684	15,450	14,132	16,428	19,477	24,173	22,859	22,971	23,203
Total	179,680	181,112	229,505	266,972	308,082	432,410	963,742	1,073,065	1,000,384	941,285

-- = No distributions or data not available.

Source: (32).

programs, the Needy Family Program, and the Temporary Emergency Food Assistance Program (TEFAP). These donations displaced some commercial sales of margarine and cheese.

The Government also provides subsidized milk to the School Lunch Program and other child nutrition programs. Under these programs, children receive half-pints of milk free or at reduced prices. While budget reductions in the Special Milk Program lowered milk distribution (table 18), milk distribution in the child nutrition programs has steadily increased since 1982. The Federal Government funds schools and other agencies participating in the child nutrition programs to purchase milk locally, based on whether the participant was eligible for free, reduced, or full price reimbursement.

A 1987 USDA report to Congress on the TEFAP program concluded that each 100 pounds of donated cheese displaces about 35 pounds of commercial cheese sales (31). TEFAP distributed about 410 million pounds of cheese to needy persons in 1986, implying that about 144 million pounds, or approximately 6 percent of commercial cheese sales, were displaced. Domestic food assistance programs distributed about 596 million pounds of cheese in 1986, displacing about 208 million pounds of commercial sales.

The TEFAP report to Congress also indicated that butter donations displace margarine sales, pound for pound (31). USDA donated 71 million pounds of butter through the TEFAP program in 1986.

World Dairy Trade

U.S. international trade in dairy products varies considerably, but dairy imports and exports are a relatively small share of disappearance. Less than 4 percent of U.S. dairy products move abroad, mostly through assistance programs.

Table 18--Milk distributed through child nutrition programs

Years	Milk distributions		
	Half-pints 1/	Gallons 1/	Pounds 1/
	<u>Million</u>		
1977	7,211.2	450.7	3,876.0
1978	7,221.2	451.3	3,881.2
1979	7,289.0	455.6	3,918.2
1980	7,392.1	462.0	3,973.2
1981	7,042.4	440.2	3,785.7
1982	5,099.1	318.7	2,740.8
1983	5,179.1	323.7	2,783.8
1984	5,262.6	328.3	2,823.4
1985	5,369.5	335.6	2,886.2
1986	5,470.4	341.9	2,940.3

1/ Half-pints converted to gallons and pounds.

Source: (32).

Import controls restrict subsidized foreign dairy products from entering the U.S. market and undercutting the U.S. price-support program. Under import quotas, recent dairy imports have been held to modest levels. The United States imported 923 million pounds of dairy products in 1965. Imports jumped sharply in 1966 and 1967, with increased imports of butterfat mixtures. The definition which permitted importing butterfat-sugar mixtures as "ice cream" (a nonquota product) was changed, and imports then remained steady at about 1.7 billion pounds to 1972. The United States allowed substantially increased imports in 1973 and 1974, in response to sharply increased milk prices. These import actions affected dairy prices and contributed to the wide fluctuations in manufacturing-milk prices in those years.

Imports rose from 1.7 billion pounds in 1975 to 2.7 billion pounds in 1986. Imports of butter, nonfat dry milk, and American-type and processing cheese compete directly with those products made in the United States and may have strong displacement effects. More exotic cheeses, not made in the United States, compete less directly with domestic products. If the United States restricted imports of exotic cheeses, sales of other domestic cheeses likely would not increase by the same amount.

Practically all casein used in the United States is imported, since it is more profitable for U.S. processors to make nonfat dry milk, given CCC support prices. The extent that imported casein replaces domestic dairy products varies by end use. There is nearly a pound-for-pound substitution of casein in some dairy products such as cheese and ice cream. Restricting casein imports would not substantially increase utilization of U.S. dairy products in many other food and nonfood products.

Countries with high domestic support prices, especially the European Community (EC), but also other Western European countries, Canada, and the United States are primary traders of the three major dairy products (butter, cheese, and nonfat dry milk) in the world market. Exports from these countries essentially represent the excess supply from these countries that cannot be absorbed in their domestic markets at prevailing support price levels.

Most of U.S. exports result from foreign donations of CCC stocks under Title II, P.L.-480, and Section 416. Excluding shipments of dairy products to U.S. territories, exports in the 1970's normally averaged less than 1 percent of U.S. milk marketings. However, exports of U.S. dairy products rose to 3.1 billion pounds (milk-equivalent basis) during 1981, more than eight times larger than the 0.37 billion pounds in 1980. The increase was due to the sale of CCC butter to New Zealand, part of which was exported during the second half of 1981. Exports continued large in 1982, reflecting butter sales to New Zealand, increased CCC sales to CARE and the Catholic Relief Service, and a barter agreement with Jamaica. Exports decreased from the 1981 and 1982 highs after 1982. However, exports remained slightly above the 1973-80 levels because of higher foreign donations of CCC butter, cheese, and nonfat dry milk stocks under Title II, P.L.-480, and Section 416 programs.

Exports of U.S. dairy products are likely to remain small. Almost every developed country, including the United States, supports its dairy industry. Most subsidize part or all of domestic production. The United States and most other nations commonly restrict dairy imports and frequently subsidize dairy exports. Without substantial changes in international trade policies, U.S. dairy producers will continue to depend on the domestic market to buy their products.

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APPENDIXES

APPENDIX I: MODELING DEMAND FOR DAIRY PRODUCTS USING TIME-SERIES DATA

Reliable, empirical estimates of demand elasticities for dairy products are difficult to obtain. For example, Brandow states that "Numerous statistical studies of retail demands for dairy products have been made, but the small annual variations in milk production, the interdependence of the supplies of the different products, and the importance of administered pricing and price supports make precise estimates of current elasticities nearly impossible to obtain" (3). Haidacher also describes certain inherent problems due to inconsistencies between the data and the conceptual demand models commonly used (9).

We used a complete demand system approach, which is internally consistent with classical demand theory, to improve the methodology of estimating demand elasticities for dairy products (10, 11, 12). In the consumer's budgeting process, the quantity demanded of any food commodity is influenced not only by its own price and income, but also potentially by the change in any other commodity price. A complete demand system relates the quantity demanded to all prices and income. This implies an economic cross-commodity interdependence among all goods.

This interdependence stems largely from the consumer's budget constraint. Given product prices and incomes, consumers allocate their budget over all goods and services. A change in the price of one item changes the relative prices of all items. And a change in the price of a given good potentially changes the quantities of other goods. For example, with all other (nominal) prices and income unchanged, an increase in the price of ice cream generally lowers the quantity of ice cream consumed. But the quantity of sherbet will also change as sherbet becomes relatively cheaper than ice cream. Similar cross-commodity changes would potentially occur if the price of sherbet, candy, or any other commodity changed.

A CONCEPTUAL COMPLETE DEMAND SYSTEM

A demand system for n commodities was derived from classical demand theory, wherein a representative consumer's utility function (satisfaction level) is maximized under a budget constraint. The demand system is represented by a set of n linear equations, with $n(n + 1)$ coefficients (parameters):

$$\begin{aligned} \dot{q}_1 &= e_{11} \dot{p}_1 + e_{12} \dot{p}_2 + \dots + e_{1n} \dot{p}_n + g_1 \dot{m} \\ &\vdots \\ \dot{q}_n &= e_{n1} \dot{p}_1 + e_{n2} \dot{p}_2 + \dots + e_{nn} \dot{p}_n + g_n \dot{m} \end{aligned}$$

where:

- \dot{q}_i = relative change in the quantity of the i th commodity,
- \dot{p}_i = relative change in the price of the i th commodity,
- \dot{m} = relative change in consumption expenditure,
- e_{ij} = demand elasticity of the i th commodity with respect to the price of the j th commodity, and
- g_i = income (expenditure) elasticity of the i th commodity.

Classical demand theory specifies that the price and income elasticities in the demand system are interdependent. They are related through Engel aggregation, homogeneity, and symmetry:

$$\text{Engel aggregation: } \sum_{i=1}^n w_i g_i = 1$$

$$\text{Homogeneity: } \sum_{j=1}^n e_{ij} = -g_i \quad \text{for } i = 1, 2, \dots, n$$

$$\text{Symmetry: } e_{ji}/w_i + g_j = e_{ij}/w_j + g_i \quad \text{for } i, j (i \neq j) = 1, 2, \dots, n,$$

where, w_i is the expenditure weight of the i th commodity in the Engel aggregation: the sum of the expenditure elasticities, weighted by the expenditure shares of corresponding commodities, equals 1. The relationship is derived from the consumer's budget constraint, whereby the sum of each individual expenditure equals the consumer's total expenditure. Homogeneity specifies that the sum of price elasticities in each demand equation equals the negative of the expenditure elasticity for that equation. Homogeneity implies that a consumer has no money illusion. Therefore, a proportional change in prices and income leaves quantity demanded unchanged. Symmetry shows the relationship between the pairwise cross-price elasticities of any two demand equations in the system. The relationship is derived from the symmetry of the Slutsky income-compensated substitution terms. Each of these constraints has been incorporated into the estimation of the empirical demand system.

THE EMPIRICAL FOOD DEMAND SYSTEMS

We measured and analyzed how prices and income affect aggregate U.S. per capita consumption of dairy products, using two recently estimated complete food demand systems (12, 10, 11). The empirical food demand systems analyze two basic questions: (1) Assuming all other demand factors are constant, how does quantity demanded react to a marginal change in income or a given food price, and (2) To what extent can a complete food demand system, with only prices and income as explanatory variables, explain the observed consumption of dairy products (11)?

One system, used to estimate elasticities for individual dairy product categories, comprises a demand system for 40 foods and 1 nonfood category estimated from a set of annual price, income, and consumption data covering 1953-83 (10). Foods were initially classified into seven groups to circumvent the problem of insufficient degrees of freedom: meats and other animal proteins, staple foods, fats and oils, fresh fruits, fresh vegetables, processed fruit and vegetables, desserts, sweeteners, and coffee. The demand structure for each commodity group and, subsequently, the demand elasticities for the individual food commodities in each group were estimated, comprising a set of 1,722 price and expenditure elasticities. The resulting parameter estimates are maximum likelihood estimates which are invariant to the ordering of commodities and to the sequence of estimation.^{1/}

The second demand system, used to estimate elasticities for total dairy products, consists of 12 aggregate food groups and 1 nonfood category (12). It is estimated using annual disappearance data for the 1950-81 period. The 12 food groups are meat, poultry, fish, eggs, dairy products, fats and oils, fresh fruit, fresh vegetables, processed fruit and vegetables, cereal and

^{1/} See (10) for a detailed description of the estimation procedures and the complete set of parameter estimates.

bakery products, sugar and sweeteners, and nonalcoholic beverages. A total of 169 own-price and cross-price elasticities and 13 expenditure elasticities are estimated.

DATA FOR THE COMPLETE DEMAND MODELS 2/

The basic data used in estimating the complete demand systems are per capita quantities and prices of each commodity, per capita consumption expenditures, and the expenditure weight, for each commodity in a base year. Expenditure weights introduce the parameter constraints in the estimation. Per capita food consumption was derived from USDA data on civilian disappearance. Expenditure weights were compiled from USDA data. Consumer price indices used to represent the various prices were obtained from the Department of Labor. Data for personal consumption expenditures were obtained from the Department of Commerce. Per capita consumption expenditure is total personal consumption expenditure, divided by the civilian population of 50 States on July 1 of each year.

Per capita expenditures represent the income variable and satisfy equality of the budget constraint in the demand system. The resulting expenditure elasticities closely reflect the income effects because the difference between disposable income and personal consumption expenditures is small. For example, disposable income amounted to \$2,828 billion in 1985 and personal consumption expenditures were \$2,601 billion.

2/ See (10, 12) for a more detailed description.

APPENDIX II: INCOME EFFECTS FROM HOUSEHOLD DATA

Appendix table 1 shows income elasticities developed from cross-section data for a broad range of dairy products. For total dairy products, the income elasticities range from 0.07 by Blaylock and Smallwood to 0.16 by Salathe (1, 20). The Salathe study used 1973 CES data, and the Blaylock and Smallwood study used the 1977/78 NFCS data. The studies also differed in the inclusion of household characteristics as explanatory variables. The Salathe study included only income and household size, while the Blaylock and Smallwood study included a number of household characteristics.

But a related study by Smallwood and Blaylock (24), which used the same model as Salathe but with NFCS data, found small elasticities very similar to Salathe's. This suggests that including socioeconomic variables, at least with the NFCS data, lowers the estimated income elasticity. On the other hand, Blaylock and Smallwood's 1986 study, while using a different model that included demographic variables and more recent CCES data than Salathe's 1979 study, had almost identical (small) elasticities as Salathe's (2). Regardless of techniques, data, or model specification, changes in income appear to have limited effects on expenditures on total dairy products.

The income elasticities for many individual dairy products were also similar across the various studies. More expensive products, which typically are more processed, generally respond more to income changes than do less expensive products. For example, fresh whole milk has a small negative expenditure elasticity (indicating that purchases decline as income increases), while yogurt has a relatively large positive elasticity of 0.76, indicating that a 10-percent increase in income raises yogurt expenditures 7.6 percent.

Appendix table 1—Income elasticities

Dairy products	Study	Data	Income elasticities
Dairy products	Salathe (1979)	CES (1972/73)	0.143 ¹ /0.161 ²
	Blaylock and Smallwood (1986)	CCES (1980/81)	.138
	Smallwood and Blaylock (1981)	NFCS (1977/78)	.153
	Blaylock and Smallwood (1983)	NFCS (1977/78)	.072
Fresh milk products	Salathe	CES	.031 ¹ /.082 ²
	Blaylock and Smallwood (1986)	CCES	.021 .048
	Blaylock and Smallwood (1983)	NFCS	-.009
Fresh whole milk	Salathe	CES	-.096 ¹ /.043 ²
	Blaylock and Smallwood (1983)	NFCS	-.134
Other fresh milk products	Salathe	CES	.360 ¹ /.384 ²
	Blaylock and Smallwood (1983)	NFCS	.264
Processed dairy products	Salathe	CES	.312 ¹ /.274 ²
Processed milk	Smallwood and Blaylock (1981)	NFCS	-.084
	Blaylock and Smallwood (1983)	NFCS	-.016

See footnotes at end of table.

Continued—

Appendix table 1--Income elasticities--continued

Dairy products	Study	Data	Income elasticities
Canned milk	Blaylock and Smallwood (1983)	NFCS	-0.118
Dry milk	Blaylock and Smallwood (1983)	NFCS	.075
Cream	Blaylock and Smallwood (1981)	NFCS	.527
	Blaylock and Smallwood (1983)	NFCS	.189
Butter	Salathe	CES	.290/.179
	Blaylock and Smallwood (1983)	NFCS	.241
	Blaylock and Smallwood (1986)	CCES	.350
Cheese	Salathe	CES	.387 ¹ /.370 ²
	Blaylock and Smallwood (1986)	CCES	.317
	Smallwood and Blaylock (1981)	NFCS	.321
	Blaylock and Smallwood (1983)	NFCS	.171
Natural American and Cheddar cheese	Blaylock and Smallwood (1983)	NFCS	.105
Processed cheese	Blaylock and Smallwood (1983)	NFCS	.126

See footnotes at end of table.

Continued--

Appendix table 1—Income elasticities—continued

Dairy products	Study	Data	Income elasticities
Ice cream and related products	Salathe	CES	0.317 ¹ /.302 ²
	Smallwood and Blaylock (1981)	NFCS	.241
	Blaylock and Smallwood (1983)	NFCS	.168
Yogurt	Salathe	CES	.759 ¹ /.605 ²
Dips	Smallwood and Blaylock (1981)	NFCS	.735
	Blaylock and Smallwood (1983)	NFCS	.451
Frozen and other dairy products	Blaylock and Smallwood (1986)	CCES	.211

Note: CES = Consumer Expenditure Survey, CCES = Continuing Consumer Expenditure Survey, NFCS = Nationwide Food Consumption Survey.

¹Based on 1972 survey.

²Based on 1973 survey.

APPENDIX III: SUPPORTING DATA

Appendix table 2--Per capita consumption of dairy products ^{1/}

Year	Fluid milk and cream 2/				Butter 5/	Cheese				Evaporated and conden- sed milk 7/	Dry milk products 8/	Frozen dairy products		
	Plain whole milk 3/	Cream and special- ty products 3/	Other milk bever- ages 4/	Total product weight		American	Italian	Miscel- laneous	Total 6/			Ice cream	Other frozen dairy products	Total frozen dairy products
Pounds														
1965	246.0	6.9	39.3	292.2	6.4	NA	NA	NA	NA	15.6	6.9	18.5	8.3	26.8
1966	242.9	6.7	41.2	290.8	5.7	6.20	1.53	2.03	9.80	15.1	7.2	18.2	8.6	26.8
1967	232.0	6.2	44.5	282.7	5.5	6.40	1.59	2.10	10.10	14.0	7.0	17.8	8.7	26.5
1968	226.1	5.9	50.3	282.2	5.7	6.60	1.74	2.25	10.60	13.7	6.9	18.4	9.0	27.4
1969	219.0	5.5	55.2	279.8	5.4	6.70	1.97	2.16	10.90	12.8	7.1	18.0	9.5	27.5
1970	213.3	5.4	58.3	277.0	5.3	7.10	2.09	2.30	11.50	12.1	6.6	17.6	9.6	27.2
1971	205.6	5.3	63.6	274.6	5.1	7.42	2.31	2.40	12.13	11.9	6.8	17.5	9.5	27.0
1972	200.6	5.3	69.6	275.6	4.9	7.78	2.63	2.69	13.10	11.0	6.6	17.3	9.6	26.9
1973	191.4	5.5	74.7	271.5	4.8	7.93	2.84	2.82	13.59	10.2	7.4	17.3	9.5	26.8
1974	180.0	5.5	76.8	262.3	4.5	8.56	2.99	2.96	14.51	9.1	6.5	17.4	9.5	26.9
1975	177.7	5.6	83.5	266.7	4.7	8.24	3.27	2.86	14.37	8.9	5.8	18.5	9.5	28.0
1976	170.2	5.6	88.3	264.1	4.3	8.98	3.60	3.05	15.63	8.6	6.3	17.9	9.1	27.0
1977	161.4	5.5	92.9	259.9	4.3	9.29	3.77	3.05	16.11	8.2	6.2	17.5	9.6	27.1
1978	156.2	5.5	95.5	257.3	4.4	9.60	4.12	3.22	16.94	7.6	6.1	17.4	9.5	26.9
1979	150.1	5.6	97.4	253.2	4.5	9.61	4.28	3.32	17.21	7.5	6.5	17.1	8.9	26.0
1980	143.5	5.7	100.5	249.6	4.5	9.68	4.47	3.47	17.62	7.1	6.2	17.3	8.8	26.1
1981	137.7	5.8	101.9	245.4	4.3	10.22	4.50	3.57	18.29	7.3	5.6	17.2	8.9	26.1
1982	133.1	6.0	102.7	241.9	4.3	11.38	4.89	3.80	20.07	7.1	5.6	17.5	8.7	26.2
1983	129.9	6.4	106.0	242.3	4.9	11.66	5.33	3.66	20.65	7.1	6.0	17.9	8.9	26.8
1984	125.1	6.9	111.3	243.3	4.9	11.88	5.82	3.87	21.57	7.5	6.3	18.0	8.9	26.9
1985	121.5	7.3	116.3	245.1	4.9	12.20	6.50	3.93	22.63	7.5	6.3	18.0	9.6	27.6
1986 9/	118.2	7.6	119.6	245.4	4.6	12.13	7.04	4.03	23.20	7.9	7.2	18.3	9.8	28.1

NA = Not available.

^{1/} All per capita consumption figures use civilian population except fluid milk and cream data, which are based on U.S. resident population.^{2/} Data revised in 1980. Fluid milk figures are aggregates of commercial sales and milk produced and consumed on farms.^{3/} Includes cream, milk-cream mixtures, sour cream, and eggnog.^{4/} Includes lowfat, skim, buttermilk, chocolate milk, and yogurt.^{5/} Includes quantities used in other dairy products.^{6/} Excludes pot and bakers cheese and cottage cheese.^{7/} Includes evaporated and condensed buttermilk.^{8/} Includes modified dry whey products beginning 1975.^{9/} Preliminary.

Appendix table 3--Yearly changes in per capita consumption of dairy products ^{1/}

Year	Fluid milk and cream				Butter	Cheese				Evaporated and condensed milk	Dry milk products	Frozen dairy products		
	Plain whole milk	Cream and specialty products	Other milk beverages	Total product weight		American	Italian	Miscellaneous	Total			Ice cream	Other frozen dairy products	Total frozen dairy products
Percent change from previous year														
1966	-1.3	-2.9	4.8	-0.5	-10.9	NA	NA	NA	NA	-3.2	4.3	-1.6	3.6	0
1967	-4.5	-7.5	8.0	-2.8	-3.5	3.2	3.9	3.4	3.1	-7.3	-2.8	-2.2	1.2	-1.1
1968	-2.5	-4.8	13.0	-.2	3.6	3.1	9.4	7.1	5.0	-2.1	-1.4	3.4	3.4	3.4
1969	-3.1	-6.8	9.7	-.9	-5.3	1.5	13.2	-4.0	2.8	-6.6	2.9	-2.2	5.6	.4
1970	-2.6	-1.8	5.6	-1.0	-1.9	6.0	6.1	6.5	5.5	-5.5	-7.0	-2.2	1.1	-1.1
1971	-3.6	-1.9	9.1	-.9	-3.8	4.5	10.5	4.3	5.5	-1.7	3.0	-.6	-1.0	-.7
1972	-2.4	0	9.4	.4	-3.9	4.9	13.9	12.1	8.0	-7.6	-2.9	-1.1	1.1	-.4
1973	-4.6	3.8	7.3	-1.5	-2.0	1.9	8.0	4.8	3.7	-7.3	12.1	0	-1.0	-.4
1974	-6.0	0	2.8	-3.4	-6.2	7.9	5.3	5.0	6.8	-10.8	-12.2	.6	0	.4
1975	-1.3	1.8	8.7	1.7	4.4	-3.7	9.4	-3.4	-1.0	-2.2	-10.8	6.3	0	4.1
1976	-4.2	0	5.7	-1.0	-8.5	9.0	10.1	6.6	8.8	-3.4	8.6	-3.2	-4.2	-3.6
1977	-5.2	-1.8	5.2	-1.6	0	3.5	4.7	0	3.1	-4.7	-1.6	-2.2	5.5	.4
1978	-3.2	0	2.8	-1.0	2.3	3.3	9.3	5.6	5.2	-7.3	-1.6	-.6	-1.0	-.7
1979	-3.9	1.8	2.0	-1.6	2.3	.1	3.9	3.1	1.6	-1.3	6.6	-1.7	-6.3	-3.3
1980	-4.4	1.8	3.2	-1.4	0	.7	4.4	4.5	2.4	-5.3	-4.6	1.2	-1.1	.4
1981	-4.0	1.8	1.4	-1.7	-4.4	5.6	0.7	2.9	3.8	2.8	-9.7	-.6	1.1	0
1982	-3.3	3.4	.8	-1.4	0	11.4	8.7	6.4	9.7	-2.7	0	1.7	-2.2	.4
1983	-2.4	6.7	3.2	.2	14.0	2.5	9.0	-3.7	2.9	0	7.1	2.3	2.3	2.3
1984	-3.7	7.8	5.0	.4	0	1.9	9.2	5.7	4.5	5.6	5.0	.6	0	.4
1985	-2.9	5.8	4.5	.7	0	2.7	11.7	1.6	4.9	0	0	0	7.9	2.6
1986	-2.7	4.1	2.8	.1	-6.1	-.6	8.3	2.5	2.5	5.3	14.3	1.7	2.1	1.8

NA = Not available.

^{1/} Computed from appendix table 2.

Appendix table 4--Population, per capita disposable income, and Consumer Price Indexes

Year	U.S. population as of July 1			Per capita disposable income		Consumer Price Index (CPI)	Retail price indexes				DPI ____ x 100 AFI	DPI ____ x 100 CPI								
	Civilian	Resident	Total (including armed forces overseas)	Current 1/	Deflated 2/		All foods (AFI)	Dairy products (DPI)	Food away from home	Food at home										
-----Million people-----													-----Dollars-----		-----1967=100-----				-----Percent-----	
1965	191.6	193.5	194.3	2,505	7,029	94.5	94.4	90.0	90.9	95.5	0.95	0.95								
1966	193.4	195.6	196.6	2,675	7,280	97.2	99.1	95.8	95.1	100.3	.99	.97								
1967	195.3	197.5	198.7	2,929	7,515	100.0	100.0	100.0	100.0	100.0	1.00	1.00								
1968	197.1	199.4	200.7	3,037	7,730	104.2	103.6	103.3	105.2	103.2	.99	1.00								
1969	199.1	201.4	202.7	3,240	7,892	109.8	108.9	106.7	111.6	108.2	.97	.98								
1970	201.9	204.0	205.1	3,489	8,133	116.3	114.9	111.8	119.9	113.7	.96	.97								
1971	204.9	206.8	207.7	3,740	8,322	121.3	118.4	115.3	126.1	116.4	.95	.97								
1972	207.5	209.3	209.9	4,000	8,563	125.3	123.5	117.1	131.1	121.6	.93	.95								
1973	209.6	211.4	211.9	4,482	9,043	133.1	141.4	127.9	141.4	141.4	.96	.90								
1974	211.6	213.3	213.9	4,854	8,867	147.7	161.7	151.9	159.4	162.4	1.03	.94								
1975	213.8	215.5	216.0	5,291	8,943	161.2	175.4	156.6	174.3	175.8	.97	.89								
1976	215.9	217.6	218.0	5,746	9,179	170.5	180.8	169.3	186.1	179.5	.99	.94								
1977	218.1	219.8	220.2	6,264	9,385	181.5	192.2	173.9	200.3	190.2	.96	.90								
1978	220.5	222.1	222.6	6,969	9,736	195.4	211.4	185.6	218.4	210.2	.95	.88								
1979	123.0	224.6	225.1	7,682	9,830	217.4	234.5	207.1	242.9	232.9	.95	.88								
1980	225.6	227.3	227.7	8,423	9,725	246.8	254.6	227.4	267.0	251.5	.92	.89								
1981	227.9	229.6	230.0	9,250	9,777	272.4	274.6	243.6	291.0	269.9	.89	.89								
1982	230.1	232.0	232.3	9,735	9,735	289.1	285.7	247.0	306.5	279.2	.85	.86								
1983	232.3	234.3	234.5	10,354	9,944	298.4	291.7	249.9	319.9	282.2	.84	.86								
1984	234.5	236.5	236.7	11,274	10,434	311.1	302.9	253.2	333.4	292.6	.81	.84								
1985	236.8	238.7	239.0	11,887	10,637	322.2	309.8	258.0	346.6	296.8	.80	.83								
1986 3/	239.0	241.1	241.2	12,529	10,967	328.4	319.7	258.4	360.1	305.3	.79	.81								

1/ Revised. Computed from National Income and Products Accounts.

2/ 1982 dollars.

3/ Preliminary.

Appendix table 5--Yearly changes in population, per capita disposable income, and Consumer Price Indexes ^{1/}

Year	U.S. population as of July 1			Per capita disposable income		Consumer Price Index (CPI)	Retail price indexes				DPI ____ x 100 AFI	DPI ____ x 100 CPI
	Civilian	Resident	Total (including armed forces overseas)	Current	Deflated		All foods (AFI)	Dairy products (DPI)	Food away from home	Food at home		
Percent change from previous year												
1966	0.9	1.1	1.2	6.8	3.6	2.9	5.0	6.4	4.6	5.0	3.5	1.4
1967	1.0	1.0	1.1	9.5	3.2	2.9	0.9	4.4	5.2	-.3	1.5	3.4
1968	.9	1.0	1.0	3.7	2.9	4.2	3.6	3.3	5.2	3.2	-.9	-.3
1969	1.0	1.0	1.0	6.7	2.1	5.4	5.1	3.3	6.1	4.8	-2.0	-1.7
1970	1.4	1.3	1.2	7.7	3.1	5.9	5.5	4.8	7.4	5.1	-1.1	-.7
1971	1.5	1.4	1.3	7.2	2.3	4.3	3.0	3.1	5.2	2.4	-1.1	.1
1972	1.3	1.2	1.1	7.0	2.9	3.3	4.3	1.6	4.0	4.5	-1.7	-2.6
1973	1.0	1.0	1.0	12.1	5.6	6.2	14.5	9.2	7.9	16.3	2.8	-4.6
1974	1.0	.9	.9	8.3	-1.9	11.0	14.4	18.8	12.7	14.9	7.0	3.9
1975	1.0	1.0	1.0	9.0	.9	9.1	8.5	3.1	9.3	8.3	-5.5	-5.0
1976	1.0	1.0	.9	8.6	2.6	5.8	3.1	8.1	6.8	2.1	2.2	4.9
1977	1.0	1.0	1.0	9.0	2.2	6.5	6.3	2.7	7.6	6.0	-3.5	-3.4
1978	1.1	1.0	1.1	11.3	3.7	7.7	10.0	6.7	9.0	10.5	-.9	-3.0
1979	1.1	1.1	1.1	10.2	1.0	11.3	10.9	11.6	11.2	10.8	.3	.6
1980	1.2	1.2	1.2	9.6	-1.1	13.5	8.6	9.8	9.9	8.0	-3.3	1.1
1981	1.0	1.0	1.0	9.8	.5	10.4	7.9	7.1	9.0	7.3	-2.9	-.7
1982	1.0	1.0	1.0	5.2	-.4	6.1	4.0	1.4	5.3	3.4	-4.5	-2.5
1983	1.0	1.0	.9	6.4	2.1	3.2	2.1	1.2	4.4	1.1	-2.0	-.9
1984	.9	.9	.9	8.9	4.9	4.3	3.8	1.3	4.2	3.7	-2.8	-2.4
1985	1.0	.9	1.0	5.4	1.9	3.6	2.3	1.9	4.0	1.4	-1.6	-.4
1986	.9	1.0	.9	5.4	3.1	1.9	3.2	.2	3.9	2.9	-1.7	-2.9

^{1/} Computed from appendix table 4.

Appendix table 6--All dairy products: donations, population, civilian disappearance less donations, imports, and exports ^{1/}

Year	Civilian population as of July 1	Civilian disappearance		USDA donations	Civilian disappearance less donations		U.S. dairy trade			Imports divided by total use, multiplied by 100	Exports divided by total use, multiplied by 100
		Total	Per capita		Total	Per capita	Imports	Exports	Exports ^{2/} minus imports		
	Million people	Million pounds	Pounds	-----Million pounds-----	Pounds		-----Million pounds-----			-----Percent-----	
1965	191.6	118,699	619.5	6,808	111,891	584.0	923	1,836	913	0.73	1.46
1966	193.4	116,736	603.6	4,440	112,296	580.6	2,791	778	-2,013	2.28	.64
1967	195.3	113,415	580.7	6,451	106,964	547.7	2,908	363	-2,545	2.46	.31
1968	197.1	113,663	576.7	7,490	106,173	538.7	1,780	1,185	-595	1.48	.30
1969	199.1	113,232	568.7	7,980	105,252	528.6	1,621	921	-700	1.36	.77
1970	201.9	113,212	560.7	7,649	105,563	522.8	1,874	522	-1,352	1.58	.44
1971	204.9	113,919	556.0	8,020	105,899	516.8	1,346	2,458	1,112	1.12	2.04
1972	207.5	115,883	558.5	7,406	108,477	522.8	1,694	1,470	-224	1.40	1.21
1973	209.6	115,508	551.1	7,021	108,487	517.6	3,860	654	-3,206	3.23	.55
1974	211.6	113,978	538.6	4,959	109,019	515.2	2,923	582	-2,341	2.48	.49
1975	213.8	115,423	539.9	5,796	109,627	512.8	1,669	550	-1,119	1.40	.46
1976	215.9	116,650	540.3	3,978	112,672	521.9	1,943	507	-1,436	1.62	.42
1977	218.1	118,176	541.8	6,862	111,314	510.4	1,968	465	-1,503	1.62	.38
1978	220.5	120,216	545.2	6,166	114,050	517.2	2,310	376	-1,934	1.87	.30
1979	223.0	122,160	547.8	6,238	115,922	519.8	2,305	400	-1,905	1.83	.32
1980	225.6	122,705	543.9	8,331	114,374	507.0	2,109	426	-1,683	1.67	.34
1981	227.9	123,460	541.7	8,003	115,457	506.6	2,329	3,197	868	1.80	2.47
1982	230.1	127,805	555.4	9,824	117,981	512.7	2,477	5,095	2,618	1.82	3.74
1983	232.3	133,097	573.0	14,478	118,619	510.6	2,616	3,188	572	1.87	2.28
1984	234.5	136,404	581.7	13,531	122,873	524.0	2,741	3,600	859	1.90	2.50
1985	236.8	140,686	594.1	14,244	126,442	534.0	2,776	4,805	2,029	1.86	3.23
1986 ^{3/}	239.0	142,067	594.4	12,370	129,697	542.7	2,674	1,971	-703	1.81	1.34

^{1/} Dairy products on a milk-equivalent, fat-solids basis.^{2/} Government and commercial.^{3/} Preliminary.

Appendix table 7--All dairy products: yearly changes in population, civilian disappearance, donations, civilian disappearance less donations, imports, and exports ^{1/}

Year	Civilian population as of July 1	Civilian disappearance		USDA donations	Civilian disappearance less donations		Imports	Exports
		Total	Per capita		Total	Per capita		
<u>Percent change from previous year</u>								
1966	0.9	-1.7	-2.6	-34.8	0.4	-0.6	202.4	-57.6
1967	1.0	-2.8	-3.8	45.3	-4.7	-5.7	4.2	-53.3
1968	.9	.2	-.7	16.1	-.7	-1.6	-38.8	226.4
1969	1.0	-.4	-1.4	6.5	-.9	-1.9	-8.9	-22.3
1970	1.4	0	-1.4	-4.1	.3	-1.1	15.6	-43.3
1971	1.5	.6	-.8	4.9	.3	-1.2	-28.2	370.9
1972	1.3	1.7	.4	-7.7	2.4	1.2	25.9	-40.2
1973	1.0	-.3	-1.3	-5.2	0	-1.0	127.9	-55.5
1974	1.0	-1.3	-2.3	-29.4	.5	-.5	-24.3	-11.0
1975	1.0	1.3	.2	16.9	.6	-.5	-42.9	-5.5
1976	1.0	1.1	.1	-31.4	2.8	1.8	16.4	-7.8
1977	1.0	1.3	.3	22.5	-1.2	-2.2	1.3	-8.3
1978	1.1	1.7	.6	-10.1	2.5	1.3	17.4	-19.1
1979	1.1	1.6	.5	1.2	1.6	.5	-.2	6.4
1980	1.2	.4	-.7	33.6	-1.3	-2.5	-8.5	6.5
1981	1.0	.6	-.4	-3.9	.9	-.1	10.4	650.5
1982	1.0	3.5	2.5	22.8	2.2	1.2	6.4	59.4
1983	1.0	4.1	3.1	47.4	.5	-.4	5.6	-37.4
1984	.9	2.5	1.5	-6.5	3.6	2.6	4.8	12.9
1985	1.0	3.1	2.2	5.3	2.9	1.9	1.3	33.5
1986	.9	1.0	.1	-13.2	2.6	1.6	-3.7	-59.0

^{1/} Computed from appendix table 6.